Miscellaneous Publications, No. 70.

MINISTRY OF AGRICULTURE AND FISHERIES.

FUNGUS *and* ALLIED DISEASES *of* CROPS 1925, 1926 *and* 1927.

IMPERIAL BUREAU
11 MAR. 1930
OF MYCOLOGY

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE,
And to be obtained at the Office of the
MINISTRY OF AGRICULTURE AND FISHERIES, 10, WHITEHALL PLACE, LONDON, S.W.1.
1929.
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Report
on
The Occurrence of Fungus, Bacterial and Allied Diseases of Crops
in
England and Wales.

For the Years
1925, 1926 *and* 1927.

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CONTENTS.

	PAGE
Map showing Advisory Provinces	3
Introduction	4
List of Collaborators	10
Diseases of Cereals	11
„ Potatoes	14
„ Roots and Fodder Plants	24
„ Pulse	28
„ Pasture and Forage Crops	30
„ Vegetables	32
„ Fruit	41
„ Hops and Flax	57
„ Ornamental and other Plants	60
„ Bulbs, Corms, etc.	66
Index to Parasites	70
Index to Non-Parasitic Diseases	75

ILLUSTRATIONS.

An unusual form of *Spongospora* attack on potato tubers. Facing p. 20.

Rot of potato tubers caused by *Rosellinia necatrix*. Facing p. 21.

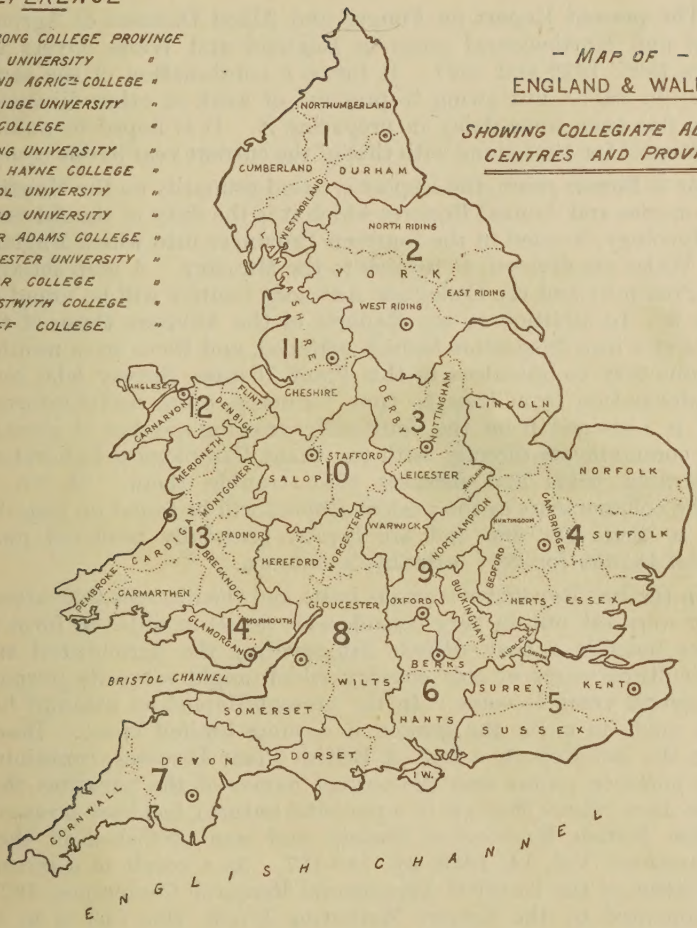
(3019.) Wt. P. 1721—2652. 600. 1/30. Wy. & S., Ltd. Gp. 2.

- REFERENCE -

1. ARMSTRONG COLLEGE PROVINCE
2. LEEDS UNIVERSITY "
3. MIDLAND AGRIC^L COLLEGE "
4. CAMBRIDGE UNIVERSITY "
5. WYE COLLEGE "
6. READING UNIVERSITY "
7. SEALE HAYNE COLLEGE "
8. BRISTOL UNIVERSITY "
9. OXFORD UNIVERSITY "
10. HARPER ADAMS COLLEGE "
11. MANCHESTER UNIVERSITY "
12. BANGOR COLLEGE "
13. ABERYSTWYTH COLLEGE "
14. CARDIFF COLLEGE "

- MAP OF - ENGLAND & WALES

SHOWING COLLEGIATE ADVISORY CENTRES AND PROVINCES.



INTRODUCTION.

The present Report on Fungus and Allied Diseases of Agricultural and Horticultural crops in England and Wales covers the years 1925, 1926 and 1927. It forms a continuation of the series begun in 1917,* but owing to pressure of work in other directions there has been some delay in preparing it. It is hoped to publish the Report for 1928 along with that of the current year in due course.

As in former years, the Report is based primarily on the Monthly Summaries and Annual Reports which it is the duty of the Advisers in Mycology, located in the fourteen Provinces into which England and Wales are divided, to furnish to the Ministry. A map showing the Provinces and the Collegiate Advisory Centres will be found on page 3. In addition to the Reports of the Advisers those of the Ministry's own Inspectors furnish material, and there are a number of voluntary co-operators in this Plant Disease Survey who send in information from time to time. Finally, much useful information is obtained from the constantly growing number of persons who communicate directly with the Plant Pathological Laboratory concerning pests and diseases that trouble them. A list of all the collaborators in the present Report will be found on page 10, and to them are due and are hereby gratefully tendered most cordial thanks for very valuable assistance.

In the last Report the various hosts and the diseases that attack them were set out in very considerable detail in order to form as far as possible a host-disease list covering the agricultural and horticultural crops of this country which might serve its purpose for several years to come. In the present Report an attempt has been made to cover the ground in a more limited space. Based upon the last Report, a List of British Plant Diseases, containing their common names and the correct names of the parasites that cause them (where they are of a parasitic nature), has been prepared by the British Mycological Society and was published in their *Transactions* Vol. 14, 1929, pp. 140-177. As a result of a recommendation of the Imperial Agricultural Research Conference, 1927, implemented by the Empire Marketing Board, this List is to be issued separately, and will be distributed to mycologists and plant pathologists throughout the Empire. The nomenclature adopted in this List has been followed as far as possible in the present

* The previous Reports were published as *Miscellaneous Publications* under the following numbers :—1917, No. 21, price 2d. ; 1918, No. 23, price 6d. ; 1919, No. 33, price 1s. 6d. ; 1920–1921, No. 38, price 3s. ; 1922–1924, No. 52, price 4s. They can be obtained from the Ministry at 10, Whitehall Place, London, S.W. 1.

Report, and it is hoped that our plant pathologists will henceforward use the names contained in it and thus secure the uniformity and consistency in regard to names that are so greatly to be desired.

In previous Reports references to current literature concerning the diseases dealt with have been given. Observations appreciative of the helpfulness of these references have been received from correspondents not only at home but also abroad. In view of this, an endeavour has been made in the present Report to make the references more complete ; and it is hoped that no really important paper, dealing with any of the diseases mentioned, and published in this country during the three-year-period under review, has been omitted. References to some of the more important papers published abroad are also included, but completeness in regard to foreign literature has not been aimed at.

It may be found that a few diseases are mentioned in the present Report that have not appeared in previous ones ; this, however, is not necessarily because they are new, but because the hosts concerned have not previously been included under the caption of "agricultural and horticultural crops." With garden crops, especially, it is often difficult to draw the line between plants grown on a small and relatively unimportant scale commercially and those constituting a horticultural crop. On the other hand, during the period covered, several parasitic fungi believed not to have been recorded previously in this country, and two entirely new ones, *Botrytis polyblastis* Dowson (p. 67) and *Actinomyces tumuli* Millard and Beeley (p. 26), have been encountered. These new records are :—

**Ascochyta Brassicae* Thüm. on Cabbage (p. 33).
Ascochyta Fabae Speg. on Broad Bean (p. 28).
Bacterium Delphinii Bryan on Delphinium (p. 60).
Botrytis narcissicola Kleb. on Narcissus (p. 67).
Cercospora Fabae Fautr. on Broad Bean (p. 28).
Penicillium Gladioli McCull. & Thom on Gladiolus (p. 68).
Phacidiella discolor (Mout. & Sacc.) Poteb. on Apple and Pear (pp. 42, 45).
Phyllosticta cucurbitacearum Sacc. on Cucumber (p. 34).
Phytophthora Richardiae Buism. on Arum (p. 69).
Plectodiscella veneta Burkh. on Raspberry (p. 53).
Pseudodiscosia Dianthi Hösterm. & Laub. on Carnation (p. 61).
Rhytisma symmetricum (Tul.) Müll. on Willow (p. 65).
†*Sclerotinia americana* Nort. & Ezek. on Peach (p. 50).
Sclerotinia Crataegi Magn. on Hawthorn (p. 47).
Sclerotinia Cydoniae Schell. on Quince (p. 50).
Sclerotium Tuliparum Kleb. on Tulip and Iris (pp. 66, 69).
Sclerotium Gladioli Massey on Gladiolus (p. 68).
Septoria Azaleae Vogl. on Azalea (p. 64).
Septoria Gladioli Pass. on Gladiolus (p. 67).
Septoria Leucanthemi Sacc. & Speg. on Shasta Daisy (p. 63).

* Previously recorded for Northern Ireland.
† On peach fruit imported from U.S.A. and Canada.

**Sporidesmium putrefaciens* Fuck. on Mangold and Beet (p. 27).
Verticillium Dahliae Kleb. on Raspberry (p. 53).
**Zopfia rhizophila* Rabenh. on Asparagus (p. 40).

Other points of special interest to which reference may be made here are the following :—The Downy Mildew of the Grape Vine (*Plasmopara viticola* (Berk. & Curt.) Berl. & de Toni), so prevalent in vineyards on the continent, made its second appearance here, after an interval of thirty-two years, in 1926, on a single outdoor vine in Kent ; but it was suppressed and has not since been seen (p. 55). The Downy Mildew of the Hop (*Pseudoperonospora Humuli* (Miy. & Tak.) Wilson), which was first noted in England in 1920, has become established not only here but also in several countries on the continent within the last few years (p. 57). Doubtless these outbreaks were ascribable to a common source of infection, although it is impossible to say what this source was. The arrival of this disease in Europe recalls that of the Potato Blight, of the two Vine Mildews and of the American Gooseberry Mildew in the previous century. *Septoria Lycopersici* Speg., which causes an important Leaf Spot disease of the Tomato in the United States of America and elsewhere, was reported in 1926 from North Wales (p. 37). It appears to have been absent from the country, or perhaps in abeyance, for about eighteen years. The occurrence of *Didymella Lycopersici* Kleb. not, as usual, on tomatoes but as a parasite of strawberries under glass (p. 55) was rather an unexpected one. The attack of Rhododendrons by *Stereum purpureum* Pers., the fungus that causes " silvering " of the foliage of most of its hosts, but not of this one, is of considerable interest (p. 46). A comparative study of the host-parasite reactions of this fungus according as to whether it causes " silvering " of the leaves or not might yield results of considerable interest. *Rosellinia necatrix* (Hart.) Berl., the so-called Vine Root Rot fungus, is not new to Britain, but until recently comparatively little was known as to its prevalence here. Our knowledge concerning it has recently been increased considerably, owing largely to the investigations of Dr. Nattrass whilst at Long Ashton (p. 44). Its polyphagous propensities are well illustrated by the fact that it has been found not only destroying the roots of fruit trees and bushes, but attacking Narcissus bulbs, Ixia and Arum corms, potato tubers and elm and bean roots. *Rhizoctonia Crocorum* (Pers.) DC., the " Copper Web " fungus, was first described more than a hundred years ago, and for more than a century it has had to be classed amongst the " sterile " forms, because its mode of reproduction remained quite unknown. The proof of its identity with *Helicobasidium purpureum* (Tul.) Pat. after much patient and painstaking work by W. Buddin and Miss Wakefield (p. 20) is therefore of more than passing interest.

As is well known, weather conditions have a great deal to do

* Parasitism perhaps doubtful.

with the incidence and intensity of plant diseases ; and, although in the British Isles the vagaries of the weather are so considerable that close correlation of the factors with outbreaks of disease is almost impossible, yet certain broad inter-connexions can be recognized. In the previous Report reference was made to the chapters on British weather in Sir J. H. Mackinder's " Britain and the British Seas," and another useful summary will be found in the Oxford Survey of the British Empire, Vol. I, Chap. 2, pp. 46-91. An interesting review of the subject of Meteorological Conditions and Plant Diseases was published by Dr. E. J. Butler in the Internat. Review of the Science and Practice of Agriculture (N.S.) 3, 1925, pp. 369-384, and those who are particularly interested in this phase of phytopathology should study the recent papers of Tehon in the U.S.A.* and of Roussakov in Russia.† These deal mainly with weather conditions as they affect epidemics of Rust in wheat, but the principles involved hold good for other crops and diseases.

Each of the three years under review was characterized by a rainfall above the normal, but while in 1925 and 1926 the excess was only slight, in 1927 it was very considerable, and of the order of 25 per cent. for the country as a whole. Moreover, it occurred largely during the summer months when its effect on epidemic plant diseases was likely to be greatest.

The year 1925 was marked by a wet May followed by a dry June and a July particularly wet in the extreme south of the country. To the warm June may be attributed the extraordinary prevalence of Yellow Rust of Wheat which, though late in appearing, became much more abundant than usual. To this dry June may also be attributed the failure of Leaf Spot of Celery to make any appreciable headway, whilst the frequency of Common Scab of Potatoes in the Northern Counties may also be ascribed to it. The early attacks of Potato Blight were in great part inhibited, and this disease made comparatively little headway until August.

The following year, 1926, was notable for a very fine August and a very wet November. Potato Blight which had appeared during wet periods in June and July was kept in check until towards the end of August, when it became epidemic with the onset of wetter weather. Showery periods in June and July in all probability determined the severity of attack of Swedes and Turnips by Finger and Toe, while the dry August appeared to be responsible for abundant mildew on this crop. The severity of Apple Scab and Leaf Spot of Celery was also attributable to the showery

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* *Tehon, L. R.* Methods and principles for interpreting the phenology of crop pests. Illinois Dept. Registr. & Educ. Div. Nat. Hist. Survey, Bull. 17, 1928, pp. 321–346.

† *Roussakov, L. F.* [Peculiarities of the micro-climate in the midst of plants in connexion with the development of cereal rusts. Trans. 4th All-Russian Entomo-Phytopath. Congress in Moscow. 1924. pp. 201–216.] In Russian. (Abstract in Rev. App. Myc. 4, 1925, p. 471).

weather in June and July. The dry August prevented the spread of Downy Mildew of Hop to the cones ; on the other hand it favoured the development of the Powdery Mildew, and the attack of the cones by this mildew was the worst experienced for several years.

The season of 1927 was distinguished by a remarkably dry May followed by a continuously wet, sunless summer. Hence such wet weather diseases as Potato Blight, Leaf Spot of Celery, Apple Scab and Downy Mildew of Hop were more than usually prevalent and destructive. The dry weather in May, however, favoured the spread of certain mildews, and probably for this reason the American Gooseberry Mildew was more severe then than it had been for a number of years previously.

As to the control of plant diseases during the period under review, the most important event from the administrative point of view was the passing of the Destructive Insects and Pests Act, 1927, amending the two previous Acts of 1907 and 1877 respectively. The new Act defines the expression " insect " more comprehensively than was formerly done, and it now includes " bacteria and other vegetable or animal organisms, and any agent causative of a transmissible crop disease." In one or two other important directions, also, the Act strengthens the hands of the Ministry and will enable it to deal more promptly and effectively than formerly with outbreaks of new diseases or visitations of foreign pests.

Of the six diseases scheduled under the D.I.P. Act three have as yet made no appearance in the country. These are " Fire Blight " (*Bacillus amylovorus* (Burr.) Trev.), Black Knot (*Plowrightia morbosa* Sacc.) and Chestnut Canker (*Endothia parasitica* Ander. & Ander.). Of the others, Wart Disease (*Synchytrium endobioticum* (Schilb.) Perc.) is being dealt with successfully, thanks to the existence and employment of immune varieties (p. 18), whilst the spread of Onion and Leek Smut (*Urocystis Cepulae* Frost) (p. 39) has been very slight, two fresh cases only—both in the North of England—having been found during the three years. With Downy Mildew of Hops, unfortunately, matters are different, for both in this country and on the Continent this new disease has clearly come to stay (p. 57). One of the puzzling features connected with it is its occurrence on wild hops in several counties far removed from those in which hops are cultivated.

Our knowledge of ways and means of combating plant diseases has steadily advanced during the three years and we are becoming much less dependent than formerly for assistance upon the results of work done in foreign countries. It is impossible to refer to all that has been and is being done, but the following may be alluded to here :—The co-operative Bunt control experiments that have been started (p. 11) ; trials of Swedes resistant to Finger and Toe disease (p. 24) ; the successful practical control of Celery Leaf Spot disease (p. 35) ; spraying for Apple and Pear Scab (p. 41) ; work

on Silver Leaf disease (p. 46) ; spraying and dusting for American Gooseberry Mildew (p. 51) ; the possibility of better control of Reversion in black currants (p. 52) and of the various diseases of Raspberries (p. 53) now that their respective causes are better understood. In glasshouse work probably the most important development in regard to disease control that has been taking place in recent years is the extension of the practice of partial soil sterilization. An excellent account of the methods in use was written by the Director of the Experimental and Research Station, Cheshunt (Dr. W. F. Bewley) and published in the Ministry's *Journal*, Vol. 33. July, 1926, pp. 297-311 ; and this article, in substance, was subsequently issued as Leaflet No. 209.

Virus diseases of plants have come greatly to the forefront in recent years, and early in 1925 the scattered workers on these diseases in this country were linked up, as the result of the appointment by the Ministry of a Virus Diseases of Plants Committee. Regular joint meetings of the Committee and the various workers were held during the ensuing three years, and definite progress made. In 1927, as a result of discussion at the Imperial Agricultural Research Conference and of a resolution passed by it, the Committee was enlarged and, with assistance granted by the Empire Marketing Board, further provision has been made for intensifying research on this important branch of phytopathology.

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Plant Pathological Laboratory,
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November, 1929.

LIST OF COLLABORATORS, 1925–1927.

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„ E. M. Bear, Hailsham, Sussex.
„ A. Beaumont, Newton Abbot, Devon.
Dr. F. T. Bennett, Newcastle-upon-Tyne.
„ W. F. Bewley, Cheshunt, Herts.
„ H. R. Briton Jones, Bristol.
Mr. W. H. Broadbent, Aberystwyth.
„ F. T. Brooks, Cambridge.
„ H. Bryan, Ormskirk.
„ J. L. Bryan, London.
„ W. Buddin, Reading, Berks.
Dr. E. J. Butler, Kew, Surrey.
Mr. A. V. Campbell, Leeds.
Miss D. M. Cayley, Merton, Surrey.
Mr. W. F. Cheal, Boston, Lincs.
„ F. J. Chittenden, Wisley, Surrey.
Miss R. S. M. Collett, Evesham, Worcs.
Mr. E. G. Cooke, Newcastle-upon-Tyne.
„ A. D. Cotton, Kew, Surrey.
„ D. W. Davies, Aberystwyth.
„ W. A. R. Dillon Weston, Cambridge.
Dr. W. J. Dowson, Wisley, Surrey.
„ H. E. Durham, Hereford.
Mr. A. Eastham, Cambridge.
Dr. J. S. Bayliss Elliot, Birmingham.
Mr. W. N. Evans, Hull.
„ G. W. Gibson, Isles of Scilly.
„ F. Glover, Preston.
„ J. F. Goaman, Hereford.
„ H. Goude, Norfolk.
„ G. C. Gough, Birmingham.
„ J. C. Gough, Reading.
„ W. B. Grove, Birmingham.
Miss E. M. Gunnell, Exeter.
Mr. C. H. Harper, Chesham Bois, Bucks.
„ R. V. Harris, East Malling.
„ A. H. Hoare, Cambridge.
Dr. A. S. Horne, London.
Mr. H. P. Hutchinson, Bristol.
„ J. Jarrett, Weston-super-Mare.
„ W. H. Jenkin, Birmingham.
„ T. Jones, Caernarvon.
Mr. J. Lansdell, Worcester.
„ W. H. Lawrance, Cardiff.
„ G. C. Maltby, London.
„ R. W. Marsh, Long Ashton, Bristol.
„ D. G. McIver, Leeds.
„ H. W. Miles, Manchester.
Dr. W. A. Millard, Leeds.
Mr. T. Moss, Manchester.
Dr. R. M. Nattrass, Long Ashton, Bristol.
Mr. C. H. Oldham, Southampton.
„ J. O. Page, Peterborough.
Dr. S. G. Paine, London.
Mr. C. E. Pearson, Sheffield.
„ N. C. Preston, Newport, Salop.
„ A. W. Proudlock, Stafford.
„ J. Ramsbottom, London.
„ J. Rees, Cardiff.
„ T. Richardson, Liverpool.
Prof. E. S. Salmon, Wye, Kent.
Miss K. Sampson, Aberystwyth.
Mr. E. Holmes Smith, Manchester.
„ G. Soane, London.
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„ J. E. Spickernell, King's Lynn, Norfolk.
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„ R. B. Strang, Chelmsford.
„ G. Taylor, Loughborough.
„ Anthony Thompson, Salisbury.
„ B. D. A. Tucker, Sheffield.
„ J. Turnbull, Maidstone, Kent.
„ A. D. Turner, Bridgewater, Somerset.
Miss E. M. Wakefield, Kew, Surrey.
Mr. A. D. Walbank, Exmouth, Devon.
Mr. W. M. Ware, Wye, Kent.
Dr. T. Whitehead, Bangor.
Miss A. P. Wilson, Swanley, Kent.
Mr. S. P. Wiltshire, Kew Green, Surrey.
„ B. L. Wolf, Birmingham.
„ N. J. Wood, South Merstham, Surrey.
Dr. R. C. Woodward, Oxford.
„ H. Wormald, East Malling, Kent.

DISEASES OF CEREALS.

WHEAT.—Outbreaks of **Black Rust** (*Puccinia graminis* Pers.) were spasmodic and scattered, being severe in a few cases only, and chiefly on experimental plots. So far as the present series of Reports is concerned, the disease was recorded in the Northern Province for the first time in 1926, and was severe in one case in Northumberland in 1927. Fewer cases than usual were reported from Wales, although due vigilance was exercised there. Barberry bushes bearing the aecidial stage were noted in a few counties, but seldom in proximity to a rusted wheat crop ; wild grasses were probably the alternate hosts in these instances. A fear was expressed by one correspondent in 1927 that large quantities of the Common Barberry (*Berberis vulgaris*) were being sold and distributed throughout the country by nurserymen. A special inquiry was therefore set on foot, but it was found that the demand for and the supply of this shrub was meagre, and had not increased in recent years. Opportunity was taken to remind nurserymen of the dangerous character of this shrub, the planting of which is to be discouraged.

The amount of **Yellow Rust** (*Puccinia glumarum* (Schm.) Erikss. and Henn.) in 1925 was much in excess of that usually recorded, but it appeared late, and in a few instances only was the yield of grain appreciably affected. A few severe outbreaks were noted in East Anglia in 1926, but in 1927 the attacks of this Rust were generally negligible, apart from one severe case in Lincs and another in Northumberland.

With the exception of one or two severe cases in 1925, very few reports of **Brown Rust** (*Puccinia triticina* Erikss.) were received, and it would appear to have been of but little economic significance,

Bunt (*Tilletia Caries* (DC.) Tul.) was common throughout the period, severe cases occurring in some counties. It was particularly prevalent in 1927 in the Northern Province, and in Lancashire and Cheshire. The use of powders (particularly copper carbonate) in place of solutions of copper sulphate or formaldehyde for seed treatment has aroused considerable attention in recent years. A series of co-operative Bunt-control experiments has therefore been organized with the aid of the Advisers in Mycology, in which the relative efficiency of copper carbonate is being tested. At the time of writing, the trials have not concluded, but it would already appear from them that, provided the seed grain is not too seriously contaminated with Bunt spores, copper carbonate dust treatment is reasonably efficacious in suppressing the disease. No case of *Tilletia foetens* (Berk. and Curt.) Trel. causing Bunt in a farmer's crop was reported, and it seems that this parasite is extremely rare in this country. An interesting account of the influence of the two Bunt fungi on the growth of the host was published in 1927 by Miss

K. Sampson and D. W. Davies, in which it was shown, amongst other things, that, contrary to what has sometimes been maintained, bunted plants are less vigorous than healthy ones. (*Ann. Appl. Biol.*, 14, 1927, p. 83.)

Loose Smut (*Ustilago Tritici* (Pers.) Jens.) fortunately occurs but sparingly in this country. Cases of some severity, however, were reported from Worcestershire in 1925 and 1926. Outbreaks of **Mildew** (*Erysiphe graminis* DC.) were slight and confined to shaded crops. **Leaf Spot** (*Septoria Tritici* Desm.) and **Glume Blotch** (*Septoria nodorum* Berk.) were noted, the former being severe in May, 1926, in Devon.

Brown Neck (*Jour. Min. Agr.*, 34, 1927–28, p. 693, and *Jour. Roy. Ag. Soc. Eng.*, 87, 1926, p. 346) was reported from a number of localities, especially during 1927. No damage appears to ensue from it, and its cause is still unknown. Judging from reports received, **Whiteheads** (*Ophiobolus graminis* Sacc.) appears to be increasing in importance, or, perhaps, to be more specifically recognized than in former years. As a rule, attacks are limited to rather small areas in individual fields, but some cases were reported where considerable portions of the crop were seriously affected. A severe outbreak was recorded (*Jour. Roy. Agric. Soc. Eng.*, 88, 1927, p. 313) in a field in Norfolk which had not, within living memory, carried a wheat crop ; and this suggested that seed transmission of the disease might have occurred. From the reports received, **Foot Root** (*Fusarium* spp.) would appear to be serious only in the more northerly parts of the country, whilst an **Ear Blight,** also associated with a *Fusarium*, gave some trouble in the same region. **Twist** (*Dilophospora Alopecuri* (Fr.) Fr.), which has rarely been reported in this country, was noted in South Devon and South Wales in 1926. **Ergot** (*Claviceps purpurea* (Fr.) Tul.) was reported on wheat on three occasions, viz., on farmers' crops in Lincs and Wiltshire and on experimental plots in Berks.

OATS.—Apart from one severe case in Berkshire in 1925, **Black Rust** was reported only occasionally and as slight. **Crown Rust** (*Puccinia Lolii* Niels.) was more widely distributed, but severe attacks were reported from South Wales only, and on winter varieties alone. The aecidial stage on *Rhamnus catharticus* was particularly abundant in 1926 in Bedfordshire and Cambridgeshire, but there was no evidence that it was connected with rust in the oat crop ; it was more probably associated with Rye Grass rust.

Smuts (*Ustilago Avenae* (Pers.) Jens. and *Ustilago Kolleri* Wille) were, as usual, widely distributed but not differentiated in the records. Their intensity was usually slight, but severe attacks were noted in Cambridgeshire and Oxfordshire in 1925, and in South Wales in 1927. Reed's demonstration (*Amer. Jour. Bot.* 11. 1924, p. 483) that " biological races " of *Ustilago avenae* exist

has been confirmed by Miss Sampson (*Ann. Appl. Biol.*, 12, 1925, p. 314).

Reports of **Leaf Spot** (*Helminthosporium Avenae* (Bri. and Cav.) Eid.) on winter oats were numerous early in the season of 1925, but in the majority of cases later reports showed that the plants had grown away from the disease, following improved weather conditions. **Mildew** was severe in 1926 at the Welsh Plant Breeding Station, and also in Cheshire; but, although frequent elsewhere, did little damage. Slight attacks of a leaf spot resembling **Halo Blight** (*Bacterium coronafaciens* Ch. Elliot) were reported from Mid Wales in each of three years under review. A bacteriological study of this disease has not yet been made in this country.

Whiteheads was prevalent in the Aberystwyth district in 1927 but did relatively little damage, whilst **Foot Rot** (*Fusarium* spp.), although more common in the Northern Counties, was reported occasionally from other districts. A **Seedling Blight,** attributed to a *Fusarium*, caused some damage in Durham in 1927, whilst ears attacked by this fungus were reported from Cumberland in the same season.

BARLEY.—During the three-year period **Black Rust** was reported but once and as slight, while **Brown Rust** (*Puccinia anomala* Rostr.) was frequent but of no serious consequence. **Yellow Rust,** generally uncommon on barley, was reported from Bucks and Cambs. in 1925, and was severe in Northumberland in 1926, where a crop had been eaten off by sheep a few months previously.

One or two serious cases of **Covered Smut** (*Ustilago Hordei* (Pers.) Kellerm. & Swing.) were reported, but complaints of this disease are comparatively infrequent, although seed is not often "pickled." **Loose Smut** (*Ustilago nuda* (Jens.) Rostr.) was seldom reported, and the attacks were slight. Tisdale and Tapke's work in the U.S.A. (*Jour. Agr. Res.*, 29, 1924, p. 263) appears to show that infection with this Smut may occur during the early seedling stage as well as at the time of flowering.

Leaf Stripe (*Helminthosporium gramineum* Rabenh.) was reported in numerous cases, but severe attacks were confined to Northants and Surrey in 1926, and East Anglia in 1927. **Net Blotch** (*Pyrenophora teres* (Died.) Drechsl.) was slight, except for one case in Cheshire. It may be noted that *Helminthosporium sativum* (Pamm., King & Bak.) was found causing a **Foot Rot** of Barley in Cambs. in 1923 (N. J. G. Smith, *Proc. Camb. Phil. Soc.* (*Biol. Sc.*), 1, 1924, p. 132). **Leaf Blotch** (*Rhynchosporium Secalis* (Oud.) Davis) has not previously been recorded on barley in this country, but appears to have been present for a few years in East Anglia, where it is giving rise to some anxiety. It was also noted on barley in Berks and Hants.

On this host **Mildew** was of little or no significance, and the same may be said of **Whiteheads** and **Ergot,** while **Fusarium Blight** was noted only in 1927 in Northumberland, where it occurred in quantity.

RYE.—Black Rust, Brown Rust (*Puccinia secalina* Grove) and **Mildew** were all reported, but they caused no appreciable damage. **Leaf Blotch** and **Stripe Smut** (*Urocystis occulta* (Wallr.) Rabenh.) were not observed, while records of **Ergot** were confined to a severe case in Cheshire and one or two cases in Yorks. A failure of seedlings in Dorset in 1925 was attributed to *Fusarium* attack.

DISEASES OF POTATOES.

Blight.—*Phytophthora infestans* (Mont.) de Bary. This continues to be the most serious of all of our potato diseases, so far as depreciation of yield and losses by decay are concerned. As a rule the earliest outbreaks are reported from western Cornwall, and it is sometimes supposed that, having once broken out in the far south-west, potato Blight spreads like a wave, advancing eastwards and northwards. This, however, is by no means what happens. In 1925, for example, although the first signs of Blight in the country were noted in Cornwall, on May 25th, yet the next report (June 10th) came from Lincolnshire, and the third (June 15th) from Northumberland. In 1926 Blight was first seen early in June in Pembrokeshire ; very shortly afterwards (June 10th) it occurred in Bedfordshire, but it was not seen in Devon and Cornwall until June 25th ; in the north it appeared first on July 20th. In 1927 it was first reported from west Cornwall on April 27th, and was seen there again on June 28th. The next report was from Lancashire, on June 30th, whilst it was not seen in Lincolnshire until July 16th. The records available show, therefore, that Blight may break out in various centres at considerable distances from one another, at approximately the same time, although the earliest outbreaks occur, on the average, in the south-west, and the latest in the north.

The incidence and the intensity of the disease are closely bound up with weather conditions. Thus, in the comparatively dry summer of 1925, Blight, although distributed all over the country, did not cause very serious losses. In that of 1926, on the other hand, wet weather over most of the country led to severe attacks and much loss. Nevertheless in the west of England, where the rainfall in 1926 was less than normal for that part of the country, Blight was less destructive than usual. It was bad all over the country in 1927, but the attacks in the principal potato growing areas were somewhat late in developing ; hence, although by the end of August the haulms were everywhere blackened, yet the proportion of blighted tubers dug proved in the end to be less than had been anticipated. Spraying against Blight was not practised to any

considerable extent, and this country falls behind some others in recognizing the value of this practical means of control.

During the period under review Blight and the fungus that causes it have been the subject of a considerable amount of investigation. P. A. Murphy and R. McKay (*Journ. Dept. Lands* and *Agric.* 24, 1924-25, p. 103) have shown that Blight does not spread from affected to healthy tubers in the pit as is commonly supposed. The popular idea that previous to about flowering time the foliage of a potato plant is resistant to attack receives some support from the work of E. J. Collins (*Proc. Linn. Soc.* 137*th Session*, 1925, p. 11) and also from that of Miss H. L. G. de Bruijn (*Tijds. o. Plantenziekten*, 32, 1926, p. 1). The previous results of Pethybridge (*Jour. Dept. Agric.* and *Tech. Instruct. Ireland*, 10, 1910, p. 244) are thus not confirmed, but the subject requires further investigation.

Miss M. P. Löhnis has written at some length (*Meded. v. d. Wetensch. Commis. v. advies en onderzoek i. h. b. v. d. volkswelvaart en weerbaarheid. Phytopath. Lab. W. C. Scholten, Baarn.* 1925) on the correlation between weather conditions and the occurrence of Blight, as well as on certain problems connected with infection. While this author failed to establish a clear-cut correlation between the incidence and spread of Blight and meteorological factors, E. van Everdingen (*Tijds. o. Plantenziekten*, 32, 1926, p. 129) calls attention to certain factors which he regards as more important, in this connexion, than some of those studied in detail by Löhnis.

Continuing her studies, Miss de Bruijn (*Phytopathology* 16, 1926, p. 121) strives to account for the recurrence of Blight year after year by the persistence of the fungus, over winter, in the soil. Although it is possible to grow the fungus saprophytically in *sterilized* soil, this author does not succeed in adducing satisfactory evidence to show that such growth can occur and be maintained over winter in ordinary natural soil. Hence persistence in the diseased tuber still remains the sole known method of hibernation of the Blight fungus. The occasional production of diseased sprouts from blighted tubers and their rôle as centres of infection for the ensuing crop has long been known. Additional examples of this have recently been recorded by E. S. Salmon and W. M. Ware (*Ann. Appl. Biol.* 13, 1926, p. 289), N. L. Alcock and A. E. S. McIntosh (*Ib.* 14, 1927, p. 440) and P. A. Murphy and R. McKay (*Sci. Proc. Roy. Dublin. Soc.* 18, (N.S.) 1927, p. 413).

P. A. Murphy (*Ib.* p. 407) has succeeded in obtaining oogonia and parthenogenetic resting spores of *P. infestans* in pure cultures on portions of potato tubers, *in vitro*, with an occasional perfectly developed set of sexual organs, including the oospore. Oogonia and parthenogenetic spores were also found on the surface of a cut tuber in the soil. The same author with R. McKay (*loc. cit.*) has demonstrated, under laboratory conditions, the emergence from blighted tubers of flies (Sciara *sp.*) carrying conidia of the potato blight fungus, and these authors have also shown how the infection of a

newly developing tuber may be brought about without the intervention of foliage infection. Further, they have discussed the relative importance of the following factors in causing primary foliage attack :—(1) the emergence of diseased shoots, (2) the production of infective material in the soil in the neighbourhood of planted blighted tubers, (3) the possible hibernation of the fungus in the soil in the open and (4) resting spores that occur sometimes on blighted tubers under natural conditions.

J. Szymanek (*Ann. des Épiphyties* 13, 1927, p. 213) has recently claimed to have observed resting spores of *P. infestans* within the necrosed tissues and on the surface of blighted potato foliage, but on what would appear to be not wholly satisfactory evidence. He has also carried out some experiments on varietal resistance to potato Blight. Other recent workers on susceptibility and resistance to Blight are R. Schander (*Landw. Jahrb.* 64, 1926, p. 91) and O. Vowinckel (*Arb. Biol. Reichsanstalt, Dahlem*, 14, 1926, p. 588). The latter author includes in his paper an account of a number of solanaceous plants (other than the potato) that may serve as hosts for *P. infestans*.

Wart Disease (*Synchytrium endobioticum* (Schilb.) Perc.).—The following notes on the incidence of this disease have kindly been supplied by Mr. J. L. Bryan, of the Horticulture Branch of the Ministry.

"The dry weather during the early months of 1925 was unfavourable to the development of this disease, and its appearance was not reported until the first week in August—a month later than in 1924. In 1926 the first report was received during the last week of July and in 1927 during the third week of that month. The cases recorded within the main Infected Area numbered 123 in 1927, 50 in 1926 and 89 in 1925 ; outside the smaller districts scheduled as Infected Areas 126 cases were discovered in 1927, 75 in 1926 and 73 in 1925. The number of parishes in which Wart Disease was recorded for the first time was 24 in 1927, 12 in 1926 and 12 in 1925, field crops being affected in 8, 4 and 7 cases respectively.

"In considering these figures it must not be overlooked that the summer of 1927 was abnormally wet and consequently exceptionally favourable to the development of the disease. Doubtless a considerable proportion of the outbreaks reported during that year would have escaped detection in a drier season when the disease would have been less readily noticeable ; but the educational work amongst potato growers has resulted in many outbreaks being reported by persons ignorant concerning the disease a few years ago. The figures for 1927 need not, therefore, be regarded as an indication that the provisions of the Wart Disease Order are becoming less effective in checking the spread of the disease. In almost every case the outbreak has been due apparently to previous soil contamination but in one instance affected tubers were found in

part of a consignment of Scotch seed. The crop from another part of the same consignment, which had been planted previous to the discovery of disease in the other part, produced diseased plants scattered throughout the whole crop, and seed infection was undoubtedly the cause of this outbreak.

"The Wart Disease of Potatoes Order of 1923 has remained in force without alteration. The provisions of this Order were summarized in the previous Report (pages 21-2). The Destructive Insects and Pests Act, 1927, which amends the previous Acts of 1907 and 1877, and which received the Royal Assent on 22nd December, 1927, enables legal proceedings for an offence in connexion with the movement, sale, consignment or planting of potatoes, to be instituted at any time within 12 months from the date on which the alleged offence was committed, and also provides for a maximum penalty of £50 in respect of a second or subsequent offence in place of the previous maximum of £10.

"Two small isolated cases of Wart Disease existing in the important potato growing district of Lincolnshire (Parts of Holland) had, for some years, been the cause of considerable dislocation of the export trade, owing to the inability of the Ministry to issue the certificates required by certain countries to the effect that Wart Disease had not occurred or had not been known to exist within the specified radius of the place where the potatoes were grown. During the winter of 1924-25 the local branch of the National Farmers' Union made arrangements for the soil on the small infected plots to be removed completely to a depth of two feet, and dumped eight miles out at sea. During the season of 1925 a highly susceptible variety of potato was planted on the sites of both plots and careful inspection failed to detect the disease. That season was very unfavourable for Wart Disease and it was felt that this one year's trial could not be regarded as conclusive. A further test was accordingly made during 1926: the crops were again kept under careful observation, but no trace of the disease was seen in either case, and there appears to be no doubt that it has been effectively eradicated from these two plots."

During the three-year period under review our knowledge of Wart Disease has been augmented substantially by investigators both at home and abroad. The Ministry's scheme for testing varieties of potatoes in respect of immunity from attack has continued in full operation at Ormskirk, and an account of this work was published by the Superintendent, Mr. H. Bryan, in the *Essex Farmers' Journal* for Oct. 1926, p. 322. A. Spieckermann and P. Kotthoff (*Deut. Landw. Presse* 51, 1924, p. 114) were the first to devise a method of testing for immunity in the laboratory, instead of in the field, whilst E. Köhler (*Fortschritte der Landw.* 2, 1927, p. 115) and O. Schlumberger (*Deut. Landw. Presse*, 53, 1926, p. 1) have discussed it. Other laboratory methods are being worked out in this country (M. D. Glynne *Ann. Appl. Biol.*, 12, 1925, p. 34,

and Anon. *Scottish Jour. Agric.* 9, 1926, p. 302 and 10, 1927, p. 333) and, when fully developed, will probably prove of considerable value.

W. A. Roach and his colleagues have investigated the action of Sulphur on the Wart Disease organism (*Ann. Appl. Biol.* 12, 1925, p. 152 ; 13, 1926, p. 301, and 14, 1927, p. 422), but trials on a considerable scale showed that the disease was not exterminated when contaminated soil was dosed with this element. G. Köck (*Oestr. Zeitschr.* f. *Kartoffelbau* 1927, p. 12) reports having successfully disinfected a small plot with 1 per cent. formalin.

The conditions under which infection with the Wart Disease organism occurs have been investigated by F. Weiss (*Amer. Jour. Bot.* 12, 1925, p. 413), whilst studies on the viability of the winter sporangium have been published by M. D. Glynne (*Ann. Appl. Biol.* 13, 1926, p. 19). Important work on the bionomics of the parasite has been done by F. Esmarch (*Angew. Bot.* 8, 1926, p. 102, and 9, 1927, p. 88) and particularly by E. Köhler (*Arb. a.d. Biol. Reichsanstalt (Dahlem)* 13, 1925, p. 385 ; 14, 1926, p. 267 ; and 15, 1927, p. 135 and p. 401). K. Cartwright (*Ann. Bot.* 40, 1926, p. 391) has discussed the nature of the resistance of the host to the parasite and W. A. Roach (*Ann. Appl. Biol.* 14, 1927, p. 181), continuing his grafting experiments mentioned in the last Report, concludes that immunity is not due to any chemical compound that can traverse the plant, and suggests that an examination of the proteins in immune and susceptible varieties of potatoes is the most hopeful future line of attack on the problem. M. D. Glynne has shown (*Ann. Appl. Biol.* 13, 1926, p. 358) that some half dozen potato varieties previously classed amongst the immunes, as the result of tests in the field, are not really immune from attack, but merely very highly resistant. F. Esmarch (*Angew. Bot.* 7, 1925, p. 108) tested seventeen species of Solanaceae and added *Hyoscyamus niger* (Henbane) and *Solanum alatum* to the list of those that can act as hosts for *Synchytrium endobioticum*. F. Weiss (*Amer. Journ. Bot.* 12, 1925, p. 413) added *S. jamesii*, *S. Commersonii* and *S. chacoense*, whilst V. Ducomet and E. Foëx (*C. R. d. Séa. Acad. Agric. France* 33–34, 1926, p. 935) have added *Lycium barbarum*. J. G. O. Botjes (*Tijdschr. o. Plantenziekt.* 32, 1926, p. 33) records an apparent case of the production of a susceptible from an immune variety by bud variation. See also E. Köhler in *Arb. Biol. Reichsanst.* 15, 1927, p. 163.

Wart Disease was reported for the first time in France, Switzerland and Austria in 1925. In the Transvaal it was first recorded in 1926 and in Belgium in 1927. W. Fischer (*Deut. Landw. Presse* 54, 1927, p. 131) calls attention to the difficulties connected with the export and import of potatoes owing to the variety of official regulations in different countries, and pleads for a unified system.

Common Scab (*Actinomyces scabies* (Thaxt.) Güssow.)—In 1925 and 1926 Scab was common and was particularly severe in

some of the northern counties ; in 1927 it was reported less frequently, although there were a good many complaints of its presence on Scotch "seed" in the spring. Studies on strains of Actinomyces in their relation to Scab have been carried out at Leeds University by W. A. Millard and S. Burr (*Ann. Appl. Biol.* 13, 1926, p. 580) and show that *A. scabies* is not the sole species responsible. This species, however, was found to attack the stolons and the roots as well as the tubers. Green manuring may counteract the development of Scab, and W. A. Millard and C. B. Taylor (*Ib.* 14, 1927, p. 202), having discarded their original "preferential food" theory, suggest that the beneficial effect of green manuring is due to competitive action in which different species of Actinomyces as well as bacteria may play a part. G. B. Sandford (*Phytopathology* 16, 1926, p. 525) supposes that when Scab is controlled by a green rye crop on certain soils, this is due to the influence of the antibiotic qualities of certain predominant soil-micro-organisms on the development of *A. scabies*. G. H. Duff and C. G. Welch (*Phytopathology* 17, 1927, p. 297), working in Canada, found that the application of sulphur was not uniformly successful in controlling Scab.

Powdery (Corky) Scab, *Spongospora subterranea* (Wallr.) Lagerh. was widespread in 1925 and 1926, but not so frequently reported in 1927. Most of the cases were of the comparatively innocuous "spot" form, but in some the more serious "canker" form was present. This occurs especially in gardens and allotments. As a rule Spongospora ceases its activity when the tuber has been lifted, but a very interesting and unusual development was encountered in 1925. In a clamp of Great Scot tubers several were found in March, with conspicuous outgrowths, suggestive at first glance of Wart Disease. Microscopical examination, however, showed that Spongospora was the causative agent of the hypertrophy and not Synchytrium. The growths developed still further when the affected tubers were kept in moist sand. Specimens of this unusual form of Spongospora attack on the tuber are illustrated in Figs. 1 & 2.

Skin Spot (*Oospora pustulans* Owen & Wakef.) was frequently reported as present on Scotch "seed" potatoes, and was sometimes responsible for the death of the eyes. Practically nothing is known of the source of infection and of the early stages of development of this disease. **Silver Scurf** (*Spondylocladium atrovirens* Harz) although not infrequent was, as usual, of little economic significance. **Black Scurf** (*Corticium* (*Rhizoctonia*) *Solani* Bourd. & Galz.) was often reported on tubers, but it causes them no direct harm. Destruction of sprouts and young stems by this fungus, however, was severe in Lincs and occurred in Herts in 1925. From Yorkshire in that year, and also in 1927, the "Rosette" type of this disease was reported. The **Stem-canker** type of injury to young sprouts and shoots was particularly common in 1926, being reported from Northumberland, Cumberland, Yorkshire, Lancs, Cheshire

and Lincs, and was most severe in early varieties. In 1927 injury of this kind, resulting in "misses," was reported from Lancs, Notts, and Lincs, but the disease was apparently less prevalent than in the two previous years. During the three years no case of **Violet Root Rot** (*Rhizoctonia Crocorum* (Pers.) DC.) was reported on potatoes. At long last the perfect spore-producing stage of this fungus has been discovered (W. Buddin and Miss E. M. Wakefield, *Trans. Brit. Myc. Soc.* 12, 1927, p. 116) in the long known but rather rare fungus *Helicobasidium purpureum* (Tul.) Pat.

Black-Leg (*Bacillus phytophthorus* Appel) was more widespread in 1925 than in the two following years. It was rather more common and serious in the northern than the southern parts of the country, and appeared particularly frequently in Kerr's Pink. Five slight cases of **Pink Rot** (*Phytophthora erythroseptica* Pethybr.) were reported, from Yorks (2), Lancs, Salop and Monmouth in 1926, and one from the same plot in Yorkshire, in 1927. This disease fortunately continues to be rare in England and Wales. Losses in seed potatoes owing to **Dry Rot** (*Fusarium caeruleum* (Lib.) Sacc.) were extensive in the "chitting" houses in Lincs in 1925; and they were also reported from Lancs, Flints, Caernarvon, Staffs, and Wilts. in that year. Several cases were reported also in 1926 and 1927. The varieties chiefly affected were Sharpe's Express, May Queen, Di Vernon and Ninetyfold; but other varieties such as British Queen, Rhoderic Dhu, King Edward, Catriona and White City also suffered. Four cases of **Spraing** were reported in 1925, and in 1926 one very exceptional case was reported from Yorkshire. In 1927 there were six slight cases, and in addition the disease was found in Scotch "seed" potatoes sent to Yorkshire, being severe in Ally and Golden Wonder, less so in Field Marshall, Sharpe's Express, British Queen, King Edward and Tinwald's Perfection. The disease is contracted from the soil, and is not usually transmitted with the "seed."

It is difficult to diagnose the **Wilt** disease, due to *Verticillium albo-atrum* Reinke & Berth., with accuracy in the field, and very little is definitely known about its occurrence and distribution in this country. Two suspected cases, reported from Yorkshire and Lincolnshire, respectively, in 1925, proved unsubstantial, whilst one from Cornwall in 1927 could not be corroborated. **Black Dot** (*Colletotrichum atramentarium* (Berk. & Br.) Taubenh.) was reported from Lincs and Worcs. in 1925, from Monmouth in 1925 and 1926 and from Cornwall in 1927, being associated with haulms that were dying off. **Stalk Break** (*Sclerotinia Sclerotiorum* (Lib.) de Bary) rarely occurs on potatoes in this country. Two cases of slight damage were reported from Lincs in 1926 and 1927 respectively. **Grey Mould** (*Botrytis cinerea* Pers.) destroyed the haulm in a 15 acre low-lying field in two weeks in Durham in 1925. In 1926 it caused slight damage to foliage in Lancs, Cheshire, Lincs, and the Isles of

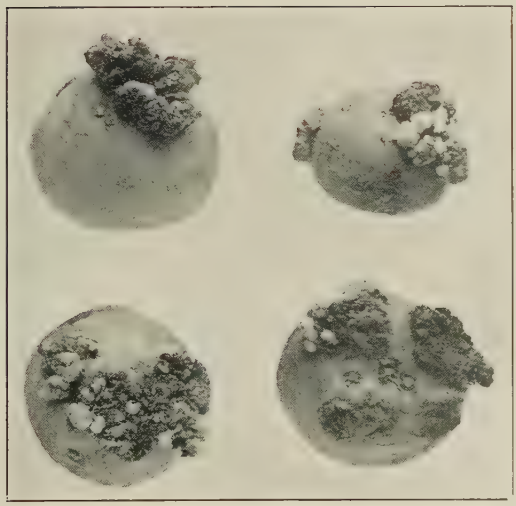

Fig. 1.

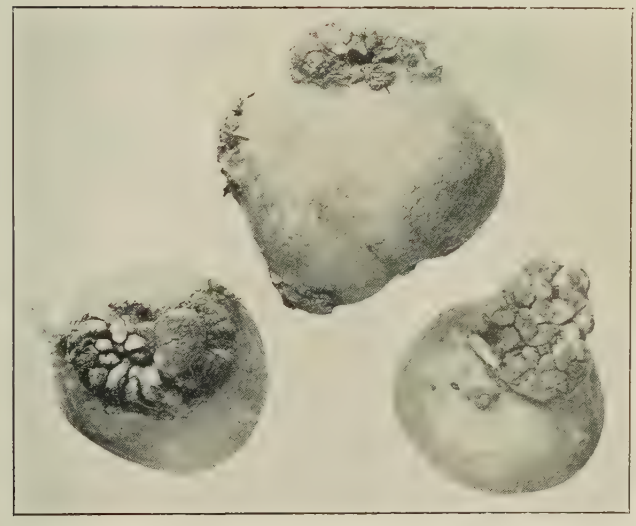

Fig. 2.

Figs. 1 & 2.—Unusual types of attack by the Powdery Scab fungus (*Spongospora subterranea*) on potato tubers. Variety Great Scot. The hypertrophied growths superficially resemble those caused by the Wart Disease organism. The growths developed in the clamp and were found when the latter was opened in March. They continued to increase subsequently when the tubers were kept in damp sand. (See p. 19.)

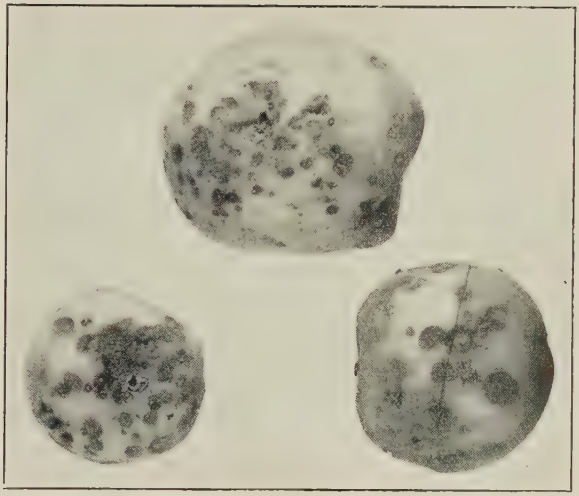

FIG. 3.

FIG. 3.—Three potato tubers attacked by the White Root Rot fungus (*Rosellinia necatrix*). Note the circular, dark, depressed areas, each with a central white spot showing point of entry of the strands of the fungus. The lower right hand tuber had been cut through before the photograph was taken.

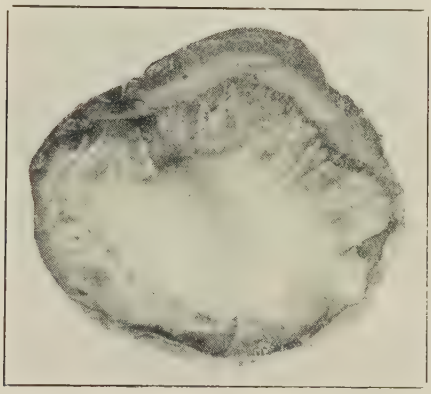

FIG. 4.

FIG. 4.—The surface exposed on cutting through a potato tuber severely attacked by the White Root Rot fungus. Note the radiating white strands of the fungus and the total decay of the tissues invaded by them.

Scilly. A tuber rot due to a species of *Phoma* was reported from Cheshire in 1925, but this disease requires further investigation.

Rosellinia necatrix (Hart.) Berl. the so-called " Vine-root- or **White Root-Rot** fungus " has been recorded on the Continent as attacking potato tubers (R. Hartig. *Text Book of the Diseases of Trees*, English Edition, London, 1894, p. 83) but, so far as is known, nothing of the kind has hitherto been recorded for this country. It is of special interest therefore to note that this fungus was found to be responsible for the destruction of a $\frac{1}{10}$th acre plot of Imperator potatoes in the Isles of Scilly in August, 1926. Shortly afterwards, an attack of the same kind, on Sharpe's Express and Rhoderic Dhu, was reported from Somerset. The fungus had been found earlier in the same season attacking Narcissus bulbs in Scilly, and it also attacks Arum corms there. In Somerset the potatoes were growing in the neighbourhood of apple trees, the roots of which had previously been attacked. The mode of attack is rather characteristic, and a somewhat early stage is illustrated in Figs. 3 & 4.

Leaf-Roll.—In 1925 a considerable number of reports on this disease were received, very few, curiously enough, from the south of England. In the Northern Province it was frequent in gardens and lowland fields, sometimes in spite of the use of Scotch " seed." On the higher grounds it was much less common, whilst in some districts (e.g. Kendal) it was almost entirely absent. In one valley at Crookham three old varieties, Victoria, Prince of Wales and Meum's Early, were found that had been grown there without change of " seed " for many years, but had remained free from virus diseases. In Yorkshire, Leaf Roll was very general and severe, especially in Snowdrop, Arran Consul and Kerr's Pink. In Lancashire and Cheshire it was prevalent in crops from home saved " seed," less so in those from Scotch " seed." In Lincolnshire crops from Scotch " seed " were said to be healthier than usual, whilst in other eastern counties Leaf Roll was general but not severe. In Wales, especially in the south, it was common in allotments where home saved " seed " was used, but not with Scotch " seed " ; it was not common in field crops. In mid-Wales, trials showed that Scotch " seed " was slightly superior to Welsh. In 1926 there were fewer reports than in 1925 and, again, very few from the south. The disease was less evident, on the whole, than in the previous year, but it was reported as generally severe in Yorkshire, and one severe case was reported from Oxon. In 1927 still fewer reports were received, and they do not refer to serious losses.

In the northern province in 1925, **Mosaic** was more general than Leaf Roll, but in Yorkshire it was slight as compared with the latter disease. In Lancs it was reported as occurring chiefly where home saved " seed " was used, and as being not very serious. It was common in Devon in cases where change of seed was not practised. In 1926 it was said to be the preponderating virus disease in North-

umberland. It was more common in Lancashire than in the previous year, since, owing to the high price of Scotch " seed " much home saved " seed " was used there. In Yorkshire it was still of minor importance, and only one severe case was reported from Lincs. In 1927 there were but few reports. It was slightly more intense than usual in the north, especially in early varieties ; in Lancashire it was noted that aphides and other insects were more abundant than usual. In Oxford it was reported as more or less severe, but in Berkshire as not very prevalent. It was very common on Arran Chief, Majestic and King Edward in mid-Wales. **Streak** was reported from Lancashire in Field Marshall in 1925, and from Northumberland, Lancs and Yorks in 1926 in Field Marshall, Majestic and Tinwald's Perfection. In 1927, it was noted in Suffolk, Kent, Glamorgan, Northumberland and Durham, often in Field Marshall, but also in Kerr's Pink, King Edward and Midlothian. **Curly Dwarf** was reported as particularly bad in Epicure in Lancs and Cheshire in 1926.

There is no doubt that increasing attention is being paid by growers to the sources from which they obtain their " seed " potatoes, and the actual losses due to virus diseases are probably decreasing rather than the reverse. Much of the " seed " used in England comes from Scotland, and is of high quality ; but that all Scotch seed is above reproach cannot yet be maintained. In the north in 1925, for example, it was noted that much of the Scotch " seed " bought by gardeners and allotment holders gave badly diseased crops. In the same year Scotch " seed " showed 75 per cent. Leaf Roll in Kerr's Pink in Durham ; and in Lancs, whilst local and Lincolnshire " seed " showed in one case only slight signs of this disease, three-quarters of the crop from Scotch " seed " was affected. In South Wales, Di Vernon showed 100 per cent. infection with Leaf Roll from Scotch " seed," whilst Majestic showed 75 per cent. in the Midlands. These cases are probably exceptional, but they show that by no means all Scotch " seed " is free from virus disease.

Research on virus diseases generally, and on those of the potato in particular, is vigorously being prosecuted, a substation for potato work having been started at the School of Agriculture, Cambridge, in 1926. Diagnosis by special methods of grafting has been elaborated by P. A. Murphy and R. McKay (*Sci. Proc. Roy. Dublin Soc.* 18, 1926, p. 169), and these authors have published further accounts of their investigations, in the Irish Free State (*Journal of the Department of Lands and Agriculture* Vols. 25, 1925-6, p. 138 and 26, 1926-7, p. 1 and p. 295). A good general account of the virus diseases of the potato was published anonymously in *The Scottish Journal of Agriculture* 8, 1925, pp. 44-55 and 176-189. Accounts of experiments on the transmission and control of Leaf Roll were published by T. Whitehead in *Welsh Jour. Agric.* 1, 1925, p. 184 and 3, 1927, p. 169. Work

on the rate of loss of water by tubers from plants affected with Leaf Roll has been published by W. McLean in *Jour. Agric. Science* 16, 1926, p. 149 and p. 318. Investigations by K. M. Smith on insect carriers were described in *Ann. Appl. Biol.* 13, 1926, p. 109 and 14, 1927, p. 113. A method of inducing early sprouting for virus disease work was described by R. N. Salaman in *Jour. Agric. Science* 17, 1927, p. 524. "Recent Work on Virus Diseases in Plants" is the title of an interesting paper by J. Henderson Smith published in the *Proc. Roy. Soc. Medicine* 20, (Path. Sect.) 1927, pp. 11-18.

The parasitic flowering plant **Dodder** (*Cuscuta*) is not often met with on potato haulms, but in 1925 three cases were reported. *C. Gronovii* was found on a few plants in Worcestershire, *C. suaveolens* and *C. tinei* in Nottinghamshire, and an unidentified species in Lincolnshire, on a few plants in each case. The species identified were kindly determined at the Royal Botanic Gardens, Kew.

DISEASES OF ROOTS AND FODDER PLANTS.

TURNIP AND SWEDE. — **Finger and Toe** (*Plasmodiophora Brassicae* Woron.) was abundant and often severe in those areas in which soils deficient in lime occur, such as in Northumberland, parts of Yorks, Staffs, Surrey, Hants, Dorset, and particularly in all parts of Wales. In 1926 the disease was more than usually severe in these districts. In general, turnips were less severely attacked than swedes. The trials with Danish resistant varieties of swedes, alluded to in the last Report, have been continued and extended. The results will be available in due course.

Powdery Mildew (*Erysiphe Polygoni* DC.) was severe in swedes in 1926, while on turnips one severe case was noted under garden conditions in Cheshire in 1925. **Downy Mildew** (*Peronospora parasitica* (Pers.) Tul.) was reported as serious on swedes in Worcs. in 1926, but elsewhere was slight. On turnips a single case was reported. **White Blister** (*Cystopus candidus* (Pers.) de Bary) was noted as slight in Wales and Northumberland on swedes, and not at all on turnips.

Dry Rot (*Phoma Lingam* (Tode) Desm.) was not serious in 1925, but in the following year severe cases were noted in Lancashire and Cheshire, in North and mid-Wales as well as in Cornwall. In some cases it was estimated that as much as forty per cent. of the crop of roots had been destroyed. In 1927 the disease was reported from the Northern and Eastern Provinces, from Anglesey, Bucks and Dorset. In one case, in Yorkshire, practically the whole crop was infected.

Canker is the name given to a disease of swedes when grown for seed, and is caused by the same parasite as that which produces Dry Rot of the root. In a previous Report, Canker was ascribed to *Phoma oleracea* Sacc. but this name is now regarded as a synonym of *P. Lingam*. The only case of Canker reported during the period under review was one in Kent, in 1925, but doubtless there were others. G. H. Cunningham has recently shown (*New Zealand Dept. of Agric.* Bull. No. 133, July, 1927) that Dry Rot is a seed-borne disease : and, since the seed of this crop used in New Zealand is almost exclusively grown in England, special attention is now being devoted to the disease in this country. Turnips are rarely affected with either Canker or Dry Rot here.

Bacterial Rots were frequently reported. In 1925 they were noted particularly in Northumberland, Durham and mid-Wales on swedes, but the losses were not great. On white turnips cases occurred in Northumberland, Yorkshire, Monmouth and Devon. **Black Rot** was reported in an experimental plot of turnips in Surrey and also in Northumberland. In 1926 these diseases were more prevalent than in the previous year. In Oxfordshire, Berkshire, Hants, Dorset and South Wales the rotting occurred subsequent

to attacks of the swede midge (*Contarinia nasturtii* Kieff.). Other cases not connected with that midge were reported from Lancashire, mid and North Wales, Lincolnshire and Wiltshire. In Warwickshire and East Devon turnips were affected. In 1927 these diseases were less widespread and less severe except in turnips, in the Northern Province, and in swedes in North and South Wales. Cases in swedes were also reported from Herefordshire and Somerset. With the exception perhaps of Black Rot, due to *Pseudomonas campestris* (Pamm.) E. F. Sm., it is not possible to correlate, without extensive cultural work, the types of bacterial rots of swedes and turnips with their respective causative organisms. The ordinary soft white rot is generally regarded as being caused by *Pseudomonas destructans* Potter, but a case of this kind studied by Wormald and Harris in 1925 was found to be due to *Bacillus carotovorus* L. R. Jones (*Ann. Appl. Biol.* 12, 1925, p. 326).

White Spot, believed to be due to the imperfectly described *Cercospora Bloxami* Berk. & Br., was recorded on swedes in Dorset and Salop in 1925. It occurred also on turnips in Cumberland in that year. In 1926 it was not reported, but in 1927 it was prevalent on turnips in Cumberland. The damage done was generally slight. A detailed study of the fungus is being made at Harper Adams College, Salop, by N. C. Preston. A **Leaf Spot,** not previously recorded in these Reports, and caused by *Alternaria Brassicae* (Berk.) Bolle, was noted on turnips in Devon in 1925 and again in 1927. In 1926 it occurred in the eastern counties on turnip, kohlrabi and kale. So far, the disease has been of no serious economic importance here. A good account of the fungus, by Miss P. C. Bolle, will be found in *Meded. Phytopath. Lab.* " *W. C. Scholten,*" VII, April, 1924, p. 27.

Stem Rot (*Sclerotinia Sclerotiorum* (Lib.) de Bary) was responsible for the loss of a crop of turnips grown for seed in Lincolnshire in 1927.

MANGOLD AND BEET.—Black Leg (*Phoma Betae* (Oud.) Frank, and *Pythium* sp.) was noted on seedlings of Mangolds in several districts, and was serious in the South Western area in 1925, completely spoiling sowings in some instances. The first named of the causal organisms given above was that most frequently responsible, although *Pythium* occurred frequently and *Aphanomyces* was associated with cases in Sussex. On Beet, one serious case only was reported in 1925, from Yorkshire ; but the disease although comparatively slight in intensity was rather widespread in the sugar beet growing areas during the three years. *Phoma Betae* was also recorded on the leaves of seedlings and on adult Sugar Beet in Yorkshire, Oxon, Northants and Northumberland. A $2\frac{1}{2}$-acre seed crop of Garden Beet was attacked by this fungus to the extent of 6 per cent. in Kent in 1926.

Heart Rot and Dry Rot ("Physiological," often followed by *Phoma Betae* (Oud.) Frank) was responsible for severe loss of Mangolds in the clamp in Berkshire in 1927, and was also reported as causing trouble in this crop in some other counties. A similar case in stored Garden Beet was noted in Devon in 1925. An interesting case of the early stage of Heart Rot (*Phyllonecrosis*) occurred on Sugar Beet in Herefordshire in 1927. The death of the heart leaves was not accompanied or followed by *Phoma Betae*, and the plants made a fairly rapid recovery. An important contribution to our knowledge of this disease was published by E. Gäumann in *Beiblatt zur Viertel jahrsschrift der Naturf. Gesellsch. in Zürich*, 70, 1925, 106 pp.

A few roots of Mangold and Beet affected with **Crown Gall** (*Bacterium tumefaciens* E. F. Sm. & Towns.) were noted, but this disease is at present of no economic significance in these crops. The same is almost true of **Scab** (*Actinomyces scabies* (Thaxt.) Güss.), although it was reported to be rather common on Mangolds in Yorkshire and Lincolnshire, in 1926, on land well known to give rise to scabby potatoes. On Sugar Beet it was reported in 1926 only, being somewhat prevalent in Lancashire and Cheshire and present in Oxon and Yorkshire. It was reported in Garden Beet in Yorkshire in 1925 and in Northumberland in 1927. In *Ann. Appl. Biology*, 14, 1927, pp. 296–311, Millard and Beeley give an account of their investigations on Mangold Scab. They recognize two forms, a pitted type, due to the organism mentioned above, and a raised type, sub-divided into "mound" and "knob" Scab. The organism that causes "mound" Scab is regarded as a distinct species, and is described as *Actinomyces tumuli*.

Violet Root-Rot (*Helicobasidium purpureum* (Tul.) Pat., formerly *Rhizoctonia Crocorum* (Pers.) DC.) was found in slight quantity at Ipswich on several varieties of Mangolds in 1925. Cases were also reported on Sugar Beet from Oxford, in 1926 and 1927, and from Cambridge in the latter year. Attacks by this fungus are usually strictly localized in the field, and seldom cause serious loss.

Rust (*Uromyces Betae* (Pers.) Tul.) was common on Mangolds in Devon in 1926, and was reported as damaging a crop in Kent in 1925, but was otherwise of slight importance. On Sugar and Garden Beet it was considerably more widespread, although seldom really serious. It was reported from Northants and Lincolnshire on Sugar Beet, whilst, on Garden Beet, a serious case was reported from Cambridgeshire, and it was severe on crops grown for seed in Berkshire and Glamorgan.

Several cases of **Downy Mildew** (*Peronospora Schachtii* Fuck.) were reported on Mangolds in Lincolnshire in 1926, whilst on Sugar Beet it was reported from Lincolnshire, East Anglia, Buckinghamshire, Berkshire and Oxon. In one case 8 per cent. of

the crop was affected. This disease appears to be becoming commoner, or perhaps more frequently recognized, in the Sugar Beet growing districts. It seems to be capable of doing considerable damage to the seed crop.

There were no reports of **Leaf Spot** (*Cercospora beticola* Sacc.) on Mangolds, but it was reported from six counties on Sugar Beet, causing little or no damage. On the Continent, however, in recent years this fungus has become very troublesome, especially in Czecho-Slovakia, Roumania, Hungary, Jugo-Slavia and Italy. Trials have shown that it can successfully be controlled by four applications of Bordeaux Mixture to the foliage during the season.

Leaf Scorch ("*Blattbräune*") has recently become recognized in this country. It was common on Mangolds in Devon and Cornwall in 1927, and on Sugar Beet in the East Midland and Eastern Provinces in the same year. *Sporidesmium putrefaciens* Fuck. was associated with this condition of the older leaves in most cases, but it has yet to be proved that this fungus is a primary parasite.

Ramularia beticola Fautr. & Lamb. was reported as causing a leaf spot of Mangolds in a single instance in Berkshire in 1926. It was not reported on Sugar Beet. A few cases of Mangold crops with a plant here and there affected with **Mosaic** were reported, but none of Sugar Beet. An exhaustive account of this disease has recently been published by K. Böning in *Forsch. a.d. Gebiet d. Pflanzenkrankheiten*, etc., *Heft.* 3, 1927, pp. 81–128. In *Heft.* 4, (p. 23 *et seq.*) of the same publication, an account is given of the discovery of certain curious intracellular bodies in the tissues of Beet leaves affected with Mosaic. The name *Elytrosoma* has been given to them; but what their significance may be is, for the present, a matter of conjecture. No authentic case of the American "Curly Top" disease of Beet, the virus of which is transmitted by the insect *Eutettix tenella* Baker has yet come to light in this country. It is not yet certain whether this particular insect is a member of the British fauna or not.

MARROW STEM KALE showed itself markedly resistant to **Finger and Toe** disease in Salop and Lincolnshire in 1925, and also in the Isles of Scilly. **White Blister** was severe on this host in Devon in 1926 and slighter attacks were reported from mid-Wales. **Downy Mildew** was severe on it in Cheshire in April, 1925, whilst it also occurred in the Reading Province in 1926 and 1927 and in Devon in the latter year. *Mycosphaerella brassicicola*, *Cercospora Bloxami* and *Gloeosporium concentricum* were found on this host in the Reading Province in 1926, whilst the last-named was severe in Hants on **THOUSAND HEADED KALE** in the spring of 1925.

DISEASES OF PULSE.

FIELD AND BROAD BEANS.—During 1925 **Chocolate Spot** (*Bacillus Lathyri* Manns and Taubenh.) was slight in intensity, only one or two severe cases being reported. This is probably to be correlated with the comparatively dry weather experienced in most districts in the early summer of that year. In 1926, however, this disease was exceptionally severe, reaching epidemic proportions in the southern half of the country. In some cases the attack was so bad that the crops were useless and had to be ploughed under. In 1927 the disease was not above normal in intensity. Seeds of Broad Beans submitted to bacteriological investigation were several times found to carry *B. Lathyri*. It is generally supposed that the disease may be transmitted through the sowing of such seed, but it must be confessed that the evidence in favour of this is neither very great in amount nor wholly satisfying in kind. Accounts of Chocolate Spot were published by Paine and Lacey some years ago (*Jour. Min. Agric.*, 29, 1922-23, p. 175 and *Ann. Appl. Biol.* 10, 1923, p. 194), but since then very little has been added to our knowledge of this important disease, although A. J. Riker recently published a short note on some isolation and infection experiments made by him whilst on a visit to this country. (*Rev. Path. Végétale*, 14, 1927, p. 199.)

In 1925 and in 1927 **Rust** (*Uromyces Fabae* (Pers.) de Bary) was frequent, but slight in intensity. In 1926 severe cases were reported from Staffordshire and Caernarvon. **Leaf Spots** due to *Ascochyta Fabae* Speg. and *Cercospora Fabae* Fautr. were reported from Devon and from Kent and Oxon, respectively in 1927. Not much damage accrued, but they deserve mention since the fungi concerned do not appear to have been recorded previously in this country. A combined **Foot Rot** and **Wilt**, associated with a species of Pythium, was reported from Wisley in 1925. Something of the same kind, due to a Sclerotinia—whether *S. Sclerotiorum* or *S. Trifoliorum* was not determined—was reported as doing considerable damage to a crop in Northamptonshire, in 1926. A field in which many plants showed characters suggestive of **Mosaic** was noted in Devon in 1927.

DWARF AND RUNNER BEANS.—**Anthracnose** (*Colletotrichum Lindemuthianum* (Sacc. and Magn.) Bri. and Cav.) was reported as severe in Northumberland, Bucks and Surrey in 1927, and was noted in Kent in 1926. **Black Root Rot** (*Thielavia basicola* Zopf) occurred at Cheshunt in 1925, and **Grey Mould** (*Botrytis cinerea* Pers.) in Kent in that year and the next. In 1926 and 1927 it was reported from Devon, and in the latter year was common in South Wales.

PEAS.—**Powdery Mildew** (*Erysiphe Polygoni* DC.) was common, and in 1926 and 1927 was rather severe; a whole crop in

Devon, in the latter year, was lost through this disease. **Downy Mildew** (*Peronospora Viciae* (Berk.) de Bary) was reported fairly frequently but not as causing serious trouble. Severe cases of **Spot** (*Ascochyta Pisi* Lib.) were noted in Northumberland, Worcestershire, Gloucestershire, Yorkshire, Cornwall and Wales, and slighter ones were of general occurrence during the period under review. The fungus is common on commercial samples of seed in this country. A couple of cases of **Stripe** were reported from Cumberland in 1926. **Root Rot** (*Aphanomyces euteiches* Drechsl.), a disease comparatively new to this country, was noted in three gardens in Staffordshire in 1925, in one of which it was present in the previous year. It was reported from the same county in 1926, but not in 1927; in the latter year, however, it was found in Devon. Stunted, ill-grown pea plants having intumescences on the haulm and pods that bore a growth of *Cladosporium* were rather common; the trouble was really due, however, to Root Rot. It has now been shown (Curzi and Barbaini, *Atti. Ist. Bot. Univ. Pavia* 3, 3, 1926, p. 91) that the fungus on these intumescences, formerly considered to be *Cladosporium Pisi* Cug. and Mac. is nothing more than the ubiquitous *C. herbarum* (Link) Fr. a species that, under ordinary conditions, is not parasitic.

DISEASES OF PASTURE AND FORAGE CROPS.

CLOVERS.—Rot (*Sclerotinia Trifoliorum* Erikss.) was severe in a large number of instances. Though most intense in the Southern and Eastern parts of the country, cases were noted as far north as Northumberland. A severe one in Cambs. in 1925 involved a loss of 40 per cent. of the plants over 50 acres, while in the East Midland district heavy damage was noted in 1926. Crimson Clover was attacked in Hants in 1925 and 1926.

Mildew (*Erysiphe Polygoni* DC.) was moderately severe in the Reading Province in 1926, and in one instance in Devon in 1927, but otherwise was of no real importance. **Scorch** (*Kabatiella caulivora* (Kirchn.) Karak.) was severe in South Wales in 1925 and 1926, and in the latter year also in Northumberland and Yorks. It was noted in Bucks in 1927 but did not prove serious. For the most recent work on this parasite see Miss K. Sampson's paper in *Trans. Brit. Myc. Soc.*, 13, 1928, p. 103. The amount of **Leaf Spot** (*Pseudopeziza Trifolii* (Biv.-Bern.) Fuck.) was about normal, severe cases occurring on Red Clover in South Wales, Yorks and Glos. It was noted as common in several provinces.

Downy Mildew (*Peronospora Trifoliorum* de Bary) was noted on two occasions—in Salop and Oxon, while **Black Blotch** (*Dothidella Trifolii* (Pers.) Bayl.-Elliott and Stans.) was severe on wild white clover in Devon in 1927, in addition to being present in Bucks, Hants, Herts, and Yorks. The *Polythrincium* stage only was observed. **Rust** (*Uromyces Trifolii* (Hedw. f.) Lév.) was noted in Bucks and Devon on Red Clover, while *Uromyces flectens* Lagerh. was noted in Bucks on white clover in 1927. **Violet Root Rot** (*Helicobasidium purpureum* (Tul.) Pat.) (see p. 20) was noted as severe in one case in Yorks in 1926, and **Black Root Rot** (*Thielavia basicola* Zopf) was noted in Lancs in 1926, attacking clovers in waterlogged soil.

LUCERNE.—Rot was noted in slight quantity in Northumberland in 1925 and in Hants in 1927. **Crown Wart** (*Urophlyctis Alfalfae* (Lagerh.) Magn.) was not serious, having been noted in 1925 only, namely, in Kent, Cambs. and Suffolk. The outbreak in Cambs. was severe, but the area involved was very small. Apart from a severe case on an experimental plot in Cambs. in 1927, **Downy Mildew** was slight. Cases were noted in the Reading Province in 1926 and in South Wales in 1927. Severe cases of **Leaf Spot** (*Pseudopeziza Medicaginis* (Lib.) Sacc.) were noted in Devon in 1926 and Dorset in 1927 respectively. The phanerogamic parasite **Broomrape** (*Orobanche minor* Sm.) was noted on this host in South Wales in 1926.

SAINFOIN.—Rot was noted in Glamorgan in 1927, while **Mildew** (*Erysiphe Polygoni* DC.) was reported from this county in 1925 and 1927. A **Leaf Spot** caused by *Ascochyta Orobi* Sacc.

was noted in South Wales in 1925 and 1926, and **Rust** (*Uromyces Onobrychidis* (Desm.) Lév.) was noted as severe on a small plot in Cambs. in 1925.

TREFOIL.—**Rot** was noted in Herts in 1926, and **Leaf Spot** was noted in Glamorgan as well as in Yorks and Berks in 1927.

VETCH.—The only disease reported on this host was a slight attack of **Downy Mildew** (*Peronospora Viciae* (Berk.) de Bary) in Cambs. in 1926.

COCKSFOOT.—**Yellow Rust** was noted in mid-Wales on both cultivated and wild plants, while **Crown Rust** was noted in South Wales. Another **Rust** (*Uromyces Dactylidis* Otth) was noted in the Northern Province in 1925 and again in 1927. **Choke** (*Epichloe typhina* (Fr.) Tul.) was noted in Suffolk and Herts in 1925 and in Bucks, Herts and Devon in 1926. It has recently been shown by Miss K. Sampson (working with the form on *Festuca rubra*) that this fungus perennates in the host tissues, and that when infected plants happen to produce seed, the seeds carry mycelium internally and give rise to infected plants (*Nature*, 121, 1928, p. 92). **Ergot** was noted at Bristol and Hereford, but not in serious quantity, while **Leaf Spot** (*Mastigosporium album* Reiss var. *muticum*) was noted in the Northern Province and in Wales. *Phyllachora graminis* Fuck. was noted in Durham in 1927 alongside a heavy infestation of wild plants.

RYE GRASS.—**Crown Rust** (*Puccinia Lolii* Niels.) was frequent in Wales in 1925 and was noted in other districts also in 1925 and 1926. **Ergot** was especially prevalent on this host in 1926 and somewhat less so in 1925; but records of **Mildew** were confined to two cases in 1925.

TALL OAT GRASS.—**Crown Rust** and **Rust** (*Puccinia Arrhenatheri* Erikss.) were noted in 1925, the former in South Wales and the latter in Northumberland, Durham and Cambs. **Smut** (*Ustilago perennans* Rostr.) was noted in the Northern Province and in South Wales, whilst **Ergot** was noted at Aberystwyth on fodder from the Midlands, and also in Salop.

TIMOTHY.—**Rust** (*Puccinia Phlei-pratensis* Erikss. and Henn.) was noted in South Wales in 1925, and **Leaf Blotch** (*Septoria culmifida* Korst.) was severe on aftermath near Cardiff in the same year.

MEADOW FOXTAIL was attacked by **Leaf Spot** in South Wales, but not severely. Indigenous strains remained healthy at Aberystwyth alongside of affected commercial stocks. **Crown Rust** was noted in South Wales on this host.

DISEASES OF VEGETABLES.

BRASSICAE (Cabbage, Cauliflower, etc.).—As usual, the most serious trouble with these crops was **Finger and Toe** (*Plasmodiophora Brassicae* Woron.). It was reported particularly from allotments and market gardens in those parts of the country where the soil is deficient in lime. Although the intelligent application of lime combined with suitable crop rotation is a well-known means of preventing the disease, yet growers seem unable or unwilling to adopt this remedy. Some of the market gardeners in Northumberland, however, are an exception, and have succeeded in stamping out the disease by this means. Trials in progress at the Harper Adams Agricultural College have shown that under some circumstances "puddling" in cabbage or broccoli plants with half a pint of a 0·1 per cent. solution of corrosive sublimate, and watering each plant about three months later with the same solution, is a promising means of keeping this disease in check; but the extremely poisonous nature of this chemical will militate against its being recommended for general use, and the method is hardly applicable on a large scale.

Stem Rot (*Phoma Lingam* (Tode) Desm.) caused severe damage to cabbages in one instance in Cheshire in 1926, and in the following year it was reported on the same crop in the Midland Province, and on broccoli in Staffs and Herts. **Black Rot** (*Pseudomonas campestris* (Pamm.) E. F. Sm.) caused severe losses in cabbages in a garden and an allotment in Yorks in 1926 and 1927. It was also reported from Lincs on cabbages in 1926.

In the spring of 1925 **Downy Mildew** (*Peronospora parasitica* (Pers.) Tul.) was reported as causing slight damage to broccoli in Durham and Lincs. In the autumn of the same year it was recorded on Brussels sprouts, cabbage and cauliflower from Lancs, Salop, Glamorgan, Monmouth and Kent. In one case the attack was exceptionally bad on late-sown cauliflowers. Two cases of serious damage to Brussels sprouts in frames, from Worcs and Lancs, were reported in 1926, whilst other slight cases on cabbage and cauliflower were noted in Lancs, Monmouth, Kent and Devon in the autumn of that year. The mildew was reported from Reading on young cauliflowers in frames in January, 1927, and on spring cabbage in March in the Northern Province, from which it was reported again in June as severe on young cauliflowers. An interesting account of this disease was published by T. H. Thung in *Tijdsc. o. Plantenziekten*, 32, 1926, p. 161. **Powdery Mildew** (*Erysiphe Polygoni* DC.) was severe on a few cabbage plants in Devon in the autumn of 1925, and was reported from the same county on garden kale in that of 1926.

Rotting of Brussels sprouts by *Botrytis* was reported from Durham and Monmouth in 1925. In 1926 a similar case was reported from Cambridge, whilst cabbages were also attacked

in Lincs, Bucks, Dorset, Devon and Cornwall. In the following year the disease was reported from the two last-named counties only, on cabbages. **Damping Off,** due to *Pythium de Baryanum* Hesse, was severe in broccoli seedlings in the open in Lancs in the autumn of 1925, and again in the spring of 1926. It caused heavy loss of young cabbages (as well as of turnips and swedes) in Northumberland in the spring of that year, and in that of the following year of cauliflowers and cabbages in the same district. *Corticium* (*Rhizoctonia*) *Solani* Bourd. and Galz. was stated to be responsible for Damping Off in Brussels sprouts and Cauliflower in Yorks in the autumn of 1926.

Of the **Leaf Spots** that known as "Ring Spot," caused by *Mycosphaerella brassicicola* (Fr.) Lindau, was, as usual, the most important. It is practically confined to the southern counties and Wales, and is most troublesome on broccoli in West Cornwall. In the last-named locality it was particularly severe in 1926 and 1927. The same disease is of considerable importance in Oregon and California, U.S.A., and a very good account of it is given by J. L. Weimer in *Jour. Agric. Research*, 32, 1926, p. 97. It is there recommended to treat the seed before sowing by immersion in water at 55° C. for ten minutes or at 50° C. for thirty minutes. It may be doubted, however, whether the seed is the sole or even the main source from which infection occurs in this country. *Gloeosporium concentricum* (Grev.) Berk. & Br. was rather severe on cauliflowers in Devon in the autumn of 1925, and was noted in 1926 in Glamorgan, and in 1927 in Dorset. **White Blister** (*Cystopus candidus* (Pers.) de Bary) was more prevalent than usual in 1926, especially in Wales and the south west of England. *Ascochyta Brassicae* Thüm. was noted in Devon in 1925, this being apparently a new record for Great Britain, although the fungus has previously been recorded for Northern Ireland. Leaf spotting due to *Alternaria Brassicae* (Berk.) Bolle was frequent on kohl-rabi, kale and turnip around Cambridge in the winter of 1926.

No cases of disease amongst **RADISHES** were reported during the three years, but **White Blister** was common on **HORSE RADISH** in one locality in North Wales in 1925, whilst the **Pale Spot** due to *Ramularia Armoraciae* Fuck. was noted in Kent and Salop in 1926 and in Berks in 1927 on this host. A severe outbreak of **Black Rot** (*Pseudomonas campestris* (Pamm.) E. F. Sm.) on **SEAKALE** was reported from Middlesex in 1926, and less severe attacks occurred in that county and in Oxford in 1927.

CUCUMBER.—Slight attacks of **Anthracnose** (*Colletotrichum oligochaetum* Cav.) were reported from Cornwall and the Lea Valley in 1925, and it was prevalent in Dorset in that year. In the two succeeding years it was not reported. **Gummosis** (*Cladosporium cucumerinum* Ell. & Arth.) was noted in Kent in 1925,

Surrey in 1926, and Warwicks in 1927, whilst **Blotch** (*Cercospora Melonis* Cooke) was reported from Cheshire in 1926, and was severe in one case in Kent in 1927. In inadequately heated greenhouses **Verticillium Wilt** (*V. albo-atrum* Reinke and Berth.) was noted on a few occasions, and was severe in Yorks in 1927. **Mildew** (*Erysiphe Cichoracearum* DC.) was noted on outdoor gherkins in Kent in 1925. It was also prevalent in Sussex and Dorset on cucumbers in that year. A slight case was noted in Glamorgan in 1927. **Grey Mould** (*Botrytis cinerea* Pers.) was severe in Devon in the autumn of 1925 and in Monmouth in 1926, while **Damping Off** (*Phytophthora* sp.) was noted at Cheshunt in 1926 and in Northumberland in 1925 ; in the latter case *Pythium de Baryanum* Hesse was concerned. *Phyllosticta cucurbitacearum* Sacc. was noted as causing a leaf spot at Cheshunt in 1926, while a **Foot Rot,** ascribed to *Bacillus carotovorus* L. R. Jones, was noted in Somerset in the same year. Investigations on the premature decay of cucumber roots under commercial conditions were carried out by Miss Wilson at the Cheshunt Research Station in 1926. A fungus having " carbonised " hyphae was thought to be of importance in connexion with the disease (*Cheshunt Exp. and Research Station, 12th Ann. Rep.*, 1926, p. 39). On **VEGETABLE MARROW, Mildew** was frequent in 1925 and 1926, becoming severe in one case in Devon in the former year. **Mosaic** was reported in small amount from South Wales, Herts, and Lincs.

CARROT.—Sclerotinia Rot (*Sclerotinia Sclerotiorum* (Lib.) de Bary) was severe on roots in store in Scilly in 1926, and on carrots imported from Holland to Salop in the same year. In 1927 it was again reported from Salop, and caused heavy loss in temporarily stored young roots in Newcastle-upon-Tyne. Severe damage was caused in Wilts. and Caernarvon in 1926 by **Violet Root Rot** (*Helicobasidium purpureum* (Tul.) Pat.) and in Lancs and Cheshire by **Soft Rot,** due probably to *Bacillus carotovorus* L. R. Jones.

PARSNIP.—Severe cases of **Canker** (Non-parasitic) were recorded frequently in 1925, especially from the Midlands ; but there was a marked diminution in the number of cases in 1926 and 1927. A trial carried out in 1925 in Derbyshire by Messrs. Stirrup and Roebuck on land which usually bears cankered crops showed that roots allowed to remain in the soil and not lifted until January showed more canker than those lifted in autumn and put into store. Two varieties, " Large Guernsey " and " Tender and True," showed less canker than others (*see Jour. Min. Agric.* 33, 1926–27, p. 824). A slight attack of **Downy Mildew** (*Plasmopara nivea* Schroet.) was noted in Kent in 1927, and **Leaf Spot** (*Ramularia pastinacae* Bub.) was severe in Cardigan in 1926.

CELERY. — The **Leaf Spot,** due to *Septoria Apii* Chester, is still the most important disease of this crop, and often causes very

serious loss. The dry weather of the early summer of 1925 was unfavourable for its development, but in 1926 it was exceptionally severe. It was again serious in 1927, particularly in the Midlands and the south. The disease occurs all over the country and appears year after year, mainly as the result of sowing infected seed. It is now difficult to secure seed which is free from the fungus, and the raisers of seed do not, apparently, fully realize their responsibilities in this matter.

The work on this and other celery diseases, referred to in the previous Report of the present series as being in progress in the Haxey District of Lincolnshire, has been continued, and has given very important practical results. Some account of it by Messrs. H. H. Stirrup and J. W. Ewan was published as *Bulletin No.* 14 of the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, in June, 1927. The most recent work tends to raise serious doubts as to whether the methods hitherto in use for seed disinfection are so entirely efficient as was at one time supposed; and this makes the raising of none but healthy seed all the more imperative. Were this done, seed treatment and spraying the crop with Bordeaux mixture would be rendered superfluous. The work at Haxey is being continued. Two lots of **PARSLEY** seed infected with *Septoria Petroselini* Desm. and cases of attack by this fungus on plants in a garden in Salop, in 1926, and in Surrey, in 1927, were noted.

Where celery is grown on a large scale **Damping off,** due to species of *Pythium* and *Phytophthora*, causes considerable loss. A very satisfactory method of preventing this by disinfecting the soil in the frames in which the seedlings are raised with diluted formalin has been evolved by Messrs. Stirrup and Ewan. This procedure has been adopted by growers increasingly, and the losses formerly experienced thus overcome. The solution used is one pint of 38 per cent. formalin in 6 gallons of water. It is watered in with a can at the rate of four gallons per frame light, the soil being about 3 inches deep. After covering the soil with sacking soaked in the formalin solution, the frame is shut up for 48 hours. It is then opened, the sacking removed, and the soil stirred thoroughly every day for 14 days. The seed may then be sown. Rakes or other implements must be disinfected with the solution before use, and other precautions taken to prevent re-contamination.

The discovery of **Root Rot** (*Phoma apiicola* Kleb.), in 1924, has been followed up, and the disease has been found to be rather more common than was suspected. In 1925 it was very generally distributed in the celery growing area in Lincs, and one case was found in Dorset. It was not reported in 1926, but a few cases were noted in 1927 in Lincs, where infected seed had been sown. **Soft Rot** (*Bacillus carotovorus* L. R. Jones) was unusually severe in a number of places in Lincs and near Salisbury in 1925, and was noted at Cheshunt in that year. A considerable portion of a

field of celery in Middlesex wilted and died in 1925. *Verticillium Dahliae* Kleb. was isolated from the diseased plants. This appears to be a new host record for this fungus.

LETTUCE.—The most serious disease of this crop is **Ring Spot,** caused by *Marssonina panattoniana* Berl. It was widely distributed and severe in 1925, some crops in Kent and Northumberland being total losses. In 1926 and 1927 attacks were much less serious. In Gloucestershire McHatty's Giant, and in Middlesex Lobjoit's Green Cos, were reported as being less severely attacked than other varieties. **Downy Mildew** (*Bremia Lactucae* Regel) was severe under glass in South Wales, and less so in Middlesex, in 1925. In 1926 slight cases were reported from Oxon, Lincs, Anglesey and Glamorgan. In 1927 it was reported from Oxon and Middlesex. It was also noted in Berks and the Midland Province out of doors. In some instances the attack subsided and a good crop was eventually obtained. There are several physiological or specialized strains of the fungus. It occurs on common weeds such as Groundsel, Sow and Field Thistles, but fortunately the strains on these plants do not pass to cultivated lettuces. Jagger has found four varieties of lettuce in the U.S.A. immune from attack there, but, tested in England, they succumbed to our local strain. Out of 68 varieties tested at Cheshunt one only—a French one, Laitue de Saint Ilan—proved resistant (*Cheshunt Experimental and Research Station*, 12*th Annual Report*, 1926, p. 35.). **Grey Mould** (*Botrytis cinerea* Pers.) was severe in a number of cases in Staffs, Herts and Cardigan, and was also reported from several other counties during the three years under review. A bacterial disease, believed to be due to *Bacterium pyocyaneum* (Gessard) Lehm. & Neum., occurred in Middlesex in 1925 in a heavily manured and overhead-watered autumn crop. The disease was thought to have been introduced with the seed. Somewhat similar attacks were reported from Bucks in 1926, and Lancs and Staffs in 1927.

TOMATO.—Damping Off and **Foot Rot** (*Phytophthora cryptogea* Pethybr. and Laff. and *P. parasitica* Dast.) were responsible for considerable losses in various parts of the country, especially in the Northern Province. A particularly serious case was reported from Salop in 1927. A method of preventing Foot Rot that has been found useful in practice is to have a good surface layer of coarse sand in the seedling boxes. In potting up, a hole should be made in the soil to receive the seedling, and, after the introduction of the latter, the hole should be filled with coarse sand instead of soil. In this way the base of the young stem is kept relatively dry and well aerated. A case of Foot Rot due to *Corticium* (*Rhizoctonia*) *Solani* Bourd. and Galz. was received from Guernsey in 1925. Control methods for this disease are given by T. Small in *Cheshunt Exp. and Res. Station*, 12*th Ann. Rep.*,

1926, p. 37, and in *Ann. Appl. Biol.*, 14, 1927, p. 290. **Stem Rot** (*Didymella Lycopersici* Kleb.) was responsible for considerable loss in Staffs in 1926, and in Northumberland, Durham and Cheshire in 1927. Rotting of the fruit due to this fungus was observed in Berks in 1925.

Thielavia basicola Zopf may cause a **Root Rot** of tomatoes, and was reported from Lincs in 1926. The results of investigations at Cheshunt on this subject by P. H. Williams were published in the *Report* alluded to above (p. 26) and in the previous one (p. 74). The Root Rot caused by *Colletotrichum atramentarium* (Berk. and Br.) Taubenh. (= C. *tabificum* Pethybr.) was reported from South Wales in 1925, from Lancs, Norfolk and Glamorgan in 1926, and from Cheshire in 1927. The **Wilt** of tomato, caused by both *Verticillium albo-atrum* Reinke and Berth. and by *V. Dahliae* Kleb. was reported from several localities in 1925 but was not severe except in one nursery in Lancs, where eelworms and *Thielavia* were also involved. It was, however, troublesome in the spring of that year in the Lea Valley, probably on account of the prevailing low temperature. In 1926 a severe case was noted in Staffs, and it was also reported from Northumberland and Devon. In 1927 considerable losses were incurred from this disease in Northumberland, Durham and Cheshire, whilst isolated cases were noted in Yorks, Lancs, Lincs and Devon.

Leaf Mould (*Cladosporium fulvum* Cooke) was widespread and often severe during the three-year period, although it was reported to be less severe than usual in the Lea Valley district in 1925. It is one of the most common and troublesome diseases of tomatoes under glass in this country, and its control, when once it has established itself, is very difficult. Good growers, however, are able to circumvent it by paying scrupulous attention to nursery hygiene and to proper regulation of ventilation and atmospheric humidity. A severe case of **Grey Mould** (*Botrytis cinerea* Pers.) was reported from North Wales in 1925, whilst **Blight** (*Phytophthora infestans* (Mont.) de Bary) was severe in one case under glass in South Wales in 1925, and in Hereford in 1927. It occurred on outdoor plants in Berks and Middlesex in that year also. **Leaf Spot,** due to *Septoria Lycopersici* Speg., was reported from Denbigh in 1926, and this appears to be the first case of its kind since 1908. **Buck-Eye Rot** (*Phytophthora parasitica* Dast.) was noted in Bucks in 1926, and Middlesex in 1927. Non-parasitic troubles of the fruit such as the so-called **Blossom End Rot, Green Back, Blotchy Ripening,** etc., were recorded in several instances, particularly in 1927. An important paper on these abnormalities was published by Bewley and White in the *Annals of Applied Biology* 13, 1926, pp. 323–338, in which the main types are illustrated in colour.

STRIPE, ascribed to *Bacillus Lathyri* Manns and Taubenh., was less prevalent than usual in the Lea Valley in 1925. A serious

attack was reported on the second crop in one locality in Lincs in that year, and it was common in that county on outdoor plants. Cases from other counties were also reported. In 1926 severe cases were observed in Yorks and Lincs, and less severe ones in Northumberland, Lancs, Salop, Glamorgan and Essex. It was prevalent in Lancs and Cheshire in 1927, and caused severe loss. Isolated cases were also reported from Northumberland, Derby, Salop, Oxon, Berks and Hants in that year. This disease, or one very like it, appears to occur in most parts of the world where tomatoes are grown. There is a tendency to regard it as more properly belonging to the group of diseases of the virus type than as being due to a specific bacillus, and further investigation is required (B. T. Dickson, *Science* (*N.S.*) 62, 1925, p. 398; T. Vanterpool, 16*th Ann. Rep. Quebec Soc. Protection of Plants*, 1923–24 (1925), p. 116 and *Phytopathology* 16, 1926, p. 311). Isolated cases of **Mosaic** in tomatoes were noted in various parts of the country during the period under review. In Lancs and Cheshire in 1927 it was particularly severe in Kondine Red and Ailsa Craig. The form known as **Aucuba Mosaic** was reported in 1926 from Lancs, Cheshire and Lincs. Special attention is being devoted to these virus diseases at Cheshunt and at Rothamsted.

ONION, LEEK, etc.—**Downy Mildew** (*Peronospora Schleideni* Unger) continues to be a serious trouble with the onion crop in many districts. It was reported particularly from the Southern and Eastern counties in 1925, often being severe, especially on the autumn sown crop. In 1926 there were fewer cases, but one was from Durham, in the north. In the following year reports of the disease came from parts of Wales as well as from Lancs and the eastern counties. It has recently been proved by Murphy and McKay that the mycelium of this fungus hibernates in the bulb; and this appears to be the chief source from which attacks subsequently arise (*Sci. Proc. Roy. Dublin Soc.* (*N.S.*) 18, 1926, p. 237. The Ministry's Leaflet No. 178 which deals with this disease has recently been rewritten). In a control trial in Cambridge, Liver of Sulphur solution proved more successful than dusting with sulphur; but in Hereford in 1926 Liver of Sulphur spraying proved of no avail.

Neck Rot (*Botrytis Allii* Munn) was particularly common on stored onions in the eastern counties in 1925, one grower being reported as having lost 100 tons. It was also fairly common in Lancs and Cheshire in that year. In 1926 it was reported from Lancs, Wilts. and London, whilst in 1927 it was severe on many allotments in Northumberland and caused storage losses in Oxford. J. C. Walker, in the U.S.A., has continued his important studies of this disease. He has shown that two additional species of Botrytis, viz. *B. byssoidea* and *B. squamosa* may be concerned with it (*Jour. Agric. Research* 33, 1926, p. 893). He has also studied the problem

of disease resistance, and has indicated that losses could largely be prevented if more satisfactory methods could be devised for drying the bulbs—especially their necks—previous to storage (*Proc. Nat. Acad. Sc.* (U.S.A.) 11, 1925, p. 183 and also *Jour. Ag. Research* 30, 1925, p. 365).

White Rot (*Sclerotium cepivorum* Berk.) In Bedfordshire and Lancashire this disease was reported in 1925 as being not so severe as in the previous year ; nevertheless, numerous cases from other counties were reported during the season, one being on shallots in Northumberland. In 1926 it was reported from Yorks, Lancs (in some places very severe), Cheshire, Herts, Hunts, Monmouth and Devon, and a case on leeks was reported from Glamorgan. Fewer records were received in 1927, but in Lancs and Cheshire it was more prevalent and severe than in the previous season. The variety trials started by Mr. Holmes Smith were continued and were extended to centres in Cambridge, South Wales and Somerset. Some varieties are undoubtedly more susceptible to attack than others, but the discovery of a thoroughly and consistently resistant variety, satisfying all requirements, has yet to be made. In the Swansea Educational Gardens the following species of *Allium* were recorded, in 1926, as being attacked :— *A. sativum*, *A. carinatum*, *A. sphaerocephalum* and *A. vineale*.

Rust (*Puccinia Porri* (Sow.) Wint.). This disease of leeks is largely confined to Northumberland and Durham, where it is particularly troublesome on second year plants grown for seed. Even in that area it is very localized, some centres being quite free from it. In 1926 it was also reported from Anglesey and Glamorgan, whilst in 1927 it was severe on all seed plants at Lowick in Northumberland, and slight cases were noted in Glamorgan and Cornwall respectively. A single plant of Wild Onion (species unknown) was found in a garden near Leeds in 1926 attacked by *Uromyces ambiguus* Lév. (verified by W. B. Grove) but it is not yet certain that this rust is distinct from *P. Porri*. The last named species was found badly affecting **Chives** in Glamorgan in 1925.

Smut (*Urocystis Cepulae* Frost) has been kept well in check, thanks to the administrative measures adopted by the Ministry. During the period under review, only two new cases have appeared, making a total of sixteen in all since the disease was first recorded in the country in 1918. Both occurred in 1925 and were in the northern counties of Durham and Lancs.

A **Soft Rot**, probably due to *Bacillus carotovorus* L. R. Jones, was reported from Lancashire in 1925, 1926 and 1927, and in the last named year from Cheshire also. Seedling onions under glass were reported from the Midland Province as **Damping Off** badly, due to the attack of *Corticium* (*Rhizoctonia*) *Solani* Bourd. & Galz. in 1925, whilst *Macrosporium parasiticum* Thüm, probably following Downy Mildew, was abundant on specimens from Cornwall in 1926.

ASPARAGUS.—In the previous Report of the present series it was stated that no diseases had been reported on this host for several years. It has been found, however, that the cultivation of this crop is by no means free from troubles due to disease, and in the Evesham district, at any rate, matters have become serious in the last two or three years. **Rust** (*Puccinia Asparagi* DC.), so troublesome in America, is fortunately absent here ; but diseases of the crown and roots are important. *Helicobasidium purpureum* (Tul.) Pat., the Violet Root Rot fungus, is the cause of some of the trouble, whilst roots frequently appear to be destroyed by a hitherto unidentified species of *Fusarium*, that develops a purplish pigment. *Zopfia rhizophila* Rabenh., on asparagus roots, was a new discovery for this country in 1925, but whether it is an active parasite or not cannot be stated with certainty. It is hoped that before long the diseases of asparagus in this country will receive the attention they deserve and require.

RHUBARB.—**Crown Rot** (*Bacterium Rhaponticum* Millard) was reported from Northumberland and Derby in 1925, from Yorks, Warwickshire, Essex, Kent and Dorset in 1926 and from Yorks and Warwickshire in 1927. Considerable damage occurred in some cases. **Rust** (*Puccinia Phragmitis* (Schum.) Körn.) was noted in Caernarvon and Kent in 1927. *Ramularia Rhei* Allesch. was reported from Essex in 1926 as causing "shot-holes," whilst in the same year *Botrytis* caused damage in badly ventilated and over-watered forcing sheds in Yorks.

As to the diseases of other vegetables it may be added that in a Lancashire Market Garden in 1927 the parasitic flowering plant **Dodder** (*Cuscuta*) was found doing extensive damage to **THYME.** Numerous cases of **MINT** attacked by **Rust** (*Puccinia Menthae* Pers.) were recorded in 1925 and 1926, from all parts of the country. They were fewer in 1927.* A **Wilt** of Mint, caused by *Verticillium Dahliae* Kleb. was reported from Middlesex in 1925, thus adding another host for this fungus. **SALSIFY,** attacked by the smut *Ustilago Tragopogonis pratensis* (Pers.) Rouss., was noted in the Midland Province in 1927.

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* *P. Menthae* Pers. was so severe in Kent and Surrey in 1926 on Peppermint as to necessitate early distillation with consequent loss of essential oil.

DISEASES OF FRUIT.

APPLE.—Scab (*Venturia inaequalis* Aderh.). This is still the most serious of all our apple diseases, and occurs all over the country. Its intensity in 1925 was not quite so severe as in the previous year, although it was still above normal. In 1926 it was more severe in the northern counties than in the southern, whilst 1927 was again a very bad Scab year. The fungus was found on the petals of the flowers of Worcester Pearmain at East Malling in 1926 and again in 1927. The discovery in this country of the overwintering of the fungus in the fallen dead leaves, and of the production of perithecia and the ejection of spores in the spring was alluded to in the last Report. This stage has now been observed in nineteen counties of England and Wales ; it doubtless occurs in all, and has only to be looked for at the proper time to be found.

Investigations on methods of controlling the disease have steadily been pursued and are yielding useful results. E. S. Salmon and W. M. Ware (*Jour. Pomol. & Hort. Science*, 4, 1925, p. 230) report observations on varietal susceptibility as well as on the early stages of attack and its progress during the season in different varieties. N. B. Bagenal, W. Goodwin, E. S. Salmon and W. M. Ware (*Jour. Min. Agric.* 32, 1925-26, p. 137) report successful results in two seasons' spraying of Bismarck with Lime Sulphur solution and Bordeaux mixture, while the same authors (*Ib.* 33, 1926-27, p. 38) describe the results of further experiments along the same lines. The control of Apple Scab under East Anglian conditions has been dealt with by F. R. Petherbridge and W. A. R. Dillon Weston (*Jour. Min. Agric.* 32, 1925-26, p. 1119), whilst the serious problem of fruit-drop induced by Lime Sulphur spraying was discussed by R. G. Hatton and N. H. Grubb (*Gard. Chron.* 79, 1926, p. 324, and *Fruit Grower* 41, 1926, p. 652), and Messrs. Goodwin, Salmon and Ware (*Gard. Chron.* 79, 1926, p. 407). There is no doubt that injury (scorching, leaf drop, russetting and fruit drop) caused to fruit trees by spraying may at times be of serious importance, and this difficult problem is now being studied at the East Malling Research Station.

Probably the most comprehensive work on Apple Scab published abroad during the period under review was " Studies of the epidemiology and control of Apple Scab " by G. W. Keitt and L. K. Jones (*Wisconsin Ag. Ex. Sta. Research Bull.* 73, 1926). " Dusting " for Scab instead of spraying has, so far, scarcely been practised in this country ; but the situation in America can be gauged from such publications as *Bulletin* 325, *Maine Agric. Expt. Sta.*, 1925. and *Bull.* 209, *Virginia Agric. Exp. Sta.*, 1927.

Mildew (*Podosphaera leucotricha* (Ell. & Everh.) Salm.). During the three years complaints of Apple Mildew became increasingly frequent, and the severity of attack in 1927 was the highest reached so far, judging from the number of reports received. Even the

fruit of Lane's Prince Albert, in Hereford and at East Malling, was so seriously attacked as to be considerably reduced in market value. Cox's Orange Pippin, Bismarck and Allington Pippin appear to be the varieties that suffer most, but no very definitely resistant varieties stand out amongst the records. The perithecia of the fungus are not particularly common or abundant, but they were reported from Yorks, Oxon and Kent in 1927, and were found on the fruits of Emneth Early (Early Victoria) at East Malling in 1926. The Mildew overwinters mainly in the form of dormant mycelium within the buds, and this matter has been the subject of detailed study by R. C. Woodward (*Trans. Brit. Myc. Soc.* 12, 1927, p. 173).

Canker (*Nectria galligena* Bres.) was as troublesome as ever, particularly, and naturally, in old, neglected orchards. Girdling of twigs and fruiting spurs was frequent, and a serious outbreak of the disease in Berks in 1927 was associated with the unskilful use of a cultivating machine. Perithecia of the fungus were observed in Cambs. early in 1925 on shrivelled fruits still hanging on the trees, and the "Eye Rot" associated with the conidial stage of the fungus was reported from that county later in the same year. **Surface Canker** (*Myxosporium corticolum* Edgert.) was reported as almost universal on Worcester Pearmain in East Anglia in 1925, and was also reported from Northumberland in 1927 ; the damage done by this fungus, however, is usually negligible. Isolated cases of **Rough Scab** (*Coniothecium chomatosporum* Corda) were reported from Cheshire, Lincs, Leics. and Dorset. **Bud Rot,** probably due to *Fusarium fructigenum* Fr., was reported as severe in the Eastern Counties in 1925, especially in Emneth Early and Lord Grosvenor.

The definite recognition for the first time in this country of an unfamiliar type of **Bark Canker,** due to *Phacidiella discolor* (Mout. & Sacc.) Poteb., deserves special mention. It was first reported from Herefordshire in "head-worked" trees by R. M. Nattrass (*Ann. Rep. Agric. & Hortic. Research Station, Long Ashton*, 1926, p. 139) and was ascribed to *Fuckelia conspicua* Marchal. In the following season it was found in apothecial condition on pear trees in Worcestershire (*Ib.* 1927, p. 99). Studies have shown that *F. conspicua* is the conidial stage of *Phacidiella discolor* which was first fully described as causing a Canker of apple trees by Potebnia (*Zeits. f. Pflanzenkr.* 22, 1912, p. 129). A Die-Back of apple branches (Lord Derby) in Cambs., ascribed provisionally by E. A. Southee and F. T. Brooks to the attacks of *Cytosporella fructorum* (*Trans. Brit. Myc. Soc.* 11, 1926, p. 213), is now known to have been due to the same parasite.

Silver Leaf (*Stereum purpureum* Pers.) was reported as frequent where top-grafting or hard pruning had been practised, otherwise its occurrence was sporadic. In 1925 Emneth Early, Newton

Wonder and Lord Grosvenor were the varieties reported chiefly attacked. *Polyporus adustus* (Willd.) Fr. was noted twice in 1925 in the Isle of Ely under conditions suggesting parasitism (F. T. Brooks, *Trans. Brit. Myc. Soc.* 10, 1925, p. 225). whilst *Fomes pomaceus* (Pers.) Lloyd was reported in that year on old apple trees in Northants. It appears to be of no practical importance.

Brown Rot (*Sclerotinia fructigena* Schroet.) was rather common on soft-fruited varieties, such as Emneth Early, during the three years, and in some scattered cases caused severe damage. The "black apple" form was particularly prevalent in Sussex, Kent and Devon in 1927. Damage to twigs by the fungus was reported from Worcs. and Hants, and conidia-bearing pustules on dead spurs were conspicuous in Essex in the spring of 1926. The need for care in picking and handling apples to avoid Brown Rot was pointed out by H. Wormald in *Jour. Min. Agric.* 34, 1927-28, p. 552. **Blossom Wilt** and **Spur Canker** (*Sclerotinia cinerea* Schroet.) were frequent in the early summer of 1925, especially on unpruned and neglected trees. Wilting shoots were reported from Somerset, whilst Die-Back and Canker due to the same fungus were noted in Lancs, Cheshire, Suffolk and Glamorgan. Severe cases were reported in 1926 from Cumberland, Merioneth, Glamorgan and Sussex, whilst it was common in Devon, serious in Kent, and noted in several other counties, both north and south. It was less frequently reported in 1927, but was noted in Lancs, Cheshire, Caernarvon, Glamorgan and Suffolk.

Bitter Rot (*Glomerella cingulata* (Stonem.) Spauld. and v. Schrenk) is fortunately not a common disease in this country. It was reported from Hants on Scarlet Victoria in 1925, and occurred in stored apples in 1926 in Berks, Dorset and Hants. It was not noted in 1927. *Gloeosporium album* Osterwald. (*Centralb. f. Bakt.* II. 18, 1907, p. 825) was noted as causing the rotting of apples in store in Berks in December, 1926. This particular fungus was first noted in England in 1924 (M. N. Kidd & A. Beaumont, *Trans. Brit. Myc. Soc.* 10, 1924, p. 107), and it has also been recorded on pears (see p. 45). **Pink Rot,** due to *Trichothecium roseum* Link, and rotting of stored fruit by *Penicillium expansum* Thom were reported occasionally, the former practically always following Scab. Fruit rot due to a *Phytophthora* (probably *P. Cactorum* (Leb. & Cohn) Schroet.) was reported from Cardiganshire in 1925. **Sooty Blotch** was more prevalent than usual in Sussex in 1925, particularly on Allington Pippin and Blenheim Orange. In 1926 there were no serious complaints, but in 1927 this form of blemish was abundant. In Sussex it was reported particularly on Lord Derby and Charles Ross, whilst it was also prevalent in Lancs, Cheshire, Middlesex and Hampshire. It was conspicuous on much of the fruit exposed for sale in the street barrows in that year. The identity of the fungus that causes Sooty Blotch in this country

is not known with certainty. It appears not to be *Gloeodes pomigena* (Schw.) Colby, the one causing Sooty Blotch in the U.S.A.

Die Back diseases were commonly noted in 1925, and such fungi as *Diaporthe perniciosa* March., *Cytospora* sp. and *Tympanis conspersa* Fr. were associated with them. The causes of Die Back are as yet by no means fully understood and are still the subject of research. Evidence that fungi are probably not always primarily responsible is adduced by H. R. Briton-Jones in *Jour. Pomol. and Hortic. Sci.* 4, 1925, p. 162. Isolated cases of **Root Rot** due to *Armillaria mellea* (Vahl) Fr. were reported from Somerset and Oxon in 1925; from Kent, Glamorgan, Somerset and Gloucestershire in 1926, and from Worcs. and Devon in 1927.

Special attention may be directed to the occurrence of **White Root Rot** caused by *Rosellinia necatrix* (Hart.) Berl. This fungus is generally believed to be somewhat rare in this country, but the difficulty of diagnosing it with certainty and without having resort to cultural work has perhaps led to its having been overlooked in the past to some extent. In 1925 it was reported as causing the death of apple trees of several varieties in Somerset, and it also occurred in the Isle of Wight. In the following year it was observed killing Lord Grosvenor trees (15-20 years old) in Somerset. The roots of adjacent trees were also attacked, but the prompt removal of the infected portions resulted in saving the trees. In 1927 trees of Cox's Orange Pippin and Bramley's Seedling were killed by the fungus in Kent and Devon respectively. Work on the disease has been carried out by R. M. Nattrass and is described in *Ann. Rep. Agric. & Hortic. Research Station, Long Ashton*, 1926, p. 66. Reference has already been made (*see* p. 21) to the attack of potatoes, Narcissus and Arum by this fungus.

Of the non-parasitic diseases **Bitter Pit** (or "Stippen") was particularly frequent in 1925 and 1926, but was reported only once in 1927. **Glassiness** was prevalent in Devon in 1926; it was common in vintage apples in Hereford in 1927 and was reported from a few other counties. Both in 1925 and again in 1927 **Leaf Scorch** was prevalent. Investigations on this trouble have been in progress for some time at Long Ashton by T. Wallace, and they are dealt with in *Jour. Pomol. and Hortic. Sci.* 4, 1925, p. 117; 5, 1925, p. 1, and *Gard. Chron.* 77, 1925, p. 273. Field observations on Leaf Scorch are described by R. G. Hatton and N. H. Grubb, of East Malling, in *Jour. Pomol. and Hortic. Sci.* 4, 1925, p. 65, whilst Leaf Scorch in the Wisbech area is dealt with by F. R. Petherbridge and his colleagues in *Jour. R. Hort. Soc.* 51, 1926, p. 324.

PEAR.—Scab (*Venturia pirina* Aderh.) was not particularly serious in 1925, but was very prevalent and severe in 1926 and 1927. Infection of the young floral organs was observed at East Malling in 1927, thus pointing to the desirability of a pre-blossom

spray, if control is to be satisfactory. The perithecial stage of the fungus has now been observed on overwintered leaves in Salop, Isle of Ely, Cambs., Herts, Bucks, Berks, Glamorgan, Monmouth, Kent, and Devon. **Mildew** is not common on pears in this country. It was noted in Northumberland in 1925 and in Hereford in 1926, but was of no practical significance. **Canker** was reported as causing a considerable amount of girdling of spurs and young shoots in the West in 1925, and in the following year loss of trusses of bloom due to Canker was experienced. In 1927 Fertility was the variety mainly attacked (H. Wormald in *Jour. Min.. Agric.* 34, 1927–28, p. 162). **Eye Rot** of the fruit, caused by the same fungus, was prevalent in East Anglia and Gloucestershire in 1926. The **Bark Canker** due to *Phacidiella discolor* (Mout. & Sacc.) Poteb., referred to under Apple (*see* p. 42), was also found on Pear in 1927, on 15–20 year old trees of Red Robin in Worcestershire (R. M. Nattrass in *Ann. Rep. Agric. and Hortic. Research Sta., Long Ashton*, 1927, p. 99). It was also recorded on this host from Warwickshire, Gloucestershire and Somerset.

Silver Leaf is rare on Pears but was reported in 1925 in isolated cases in the Isle of Ely, Suffolk and Middlesex. Fructifications of *Stereum purpureum* Pers. were noted on an old tree of Doyenné du Comice in Berks. In 1927 similar fructifications were reported from Lincs. **Brown Rot** (*Sclerotinia fructigena* Schroet.) was reported from Kent and Cornwall in 1926, and **Blossom Wilt** (*S. cinerea* Schroet.) was serious in one case in Sussex in 1925, and in Monmouth in 1926. A Blossom Wilt thought to be due to bacteria was reported from Somerset in 1925 and from a different place in the same county in 1926, but the attacks were very slight. **Leaf Blister** (*Taphrina bullata* (Berk.) Tul.) was noted in Berks in 1925 and in Herts in 1927. **Leaf Blight,** due to *Fabraea maculata* Atk., was recorded at East Malling in 1927 on those leaves of a pear tree, and those only, that were intermingled with leaves of a neighbouring Quince attacked by this fungus. Although fructifications were abundant on the Quince leaves, there were none on those of the Pear.

Bitter Rot (*Glomerella cingulata* (Stonem.) Spauld. & v. Schrenk) was reported on the fruit of a single tree in Yorks in 1926, whilst *Gloeosporium album* Osterw., was observed causing a rot of fruit still on the tree in Kent in that year. **Root Rot** due to *Armillaria mellea* (Vahl) Fr. caused considerable losses in young trees in Middlesex in 1925 and 1926. It was also reported from Bucks and Glamorgan. *Roesleria hypogaea* Thüm. & Pass. was noted in 1927 in Worcestershire on the roots of young trees in a dead or dying condition. The trees had made poor graft-unions and had been planted too deeply. **Crown Gall** (*Bacterium tumefaciens* E. F. Sm. & Towns.) was noted in abundance on Pear stocks in

Cheshire in 1925. It was also reported from Kent, and found in Somerset on trees imported from the Continent. Two cases of **Lithiasis** were received in 1926 from Leicestershire and Suffolk respectively, whilst cracking of the fruit not associated with attack by any specific parasite was rather common in 1927.

PLUM.—Silver Leaf (*Stereum purpureum* Pers.). The following summary covering the period under review has been furnished by Mr. J. L. Bryan, of the Horticulture Branch of the Ministry :—

" This disease is undoubtedly still widely prevalent in the more important plum-growing districts, but the Inspectors' Reports on intensive surveys which have been carried out in these areas during the past three seasons indicate that considerable improvement in the general condition of orchards has resulted from the requirements of the Order that all dead wood on premises where plum or apple trees are grown must be removed and burnt before the 15th of July in each year. Thousands of dead trees have been destroyed, and the removal of these centres of infection appears to have had a marked effect on the intensity of the disease. It is satisfactory to note that fruit growers generally have begun to appreciate the soundness of the requirements of the removal and destruction of dead wood, but in certain cases there is still a regrettable tendency to delay the operation to a later period than that specified in the Order. The Silver Leaf Order of 1923 (summarized on p. 67 of the previous Report) is still in operation."

In addition to its occurrence on fruit trees, the three years' records of *Stereum purpureum* cover the following hosts :—Pine, Cedar, Elm, Poplar, Aspen, Willow, Birch, Beech, Portugal and Cherry Laurels, Sloe, Myrobalan, Horse Chestnut and Rhododendron. The last-named is of special interest, since it constitutes a new host-record for the fungus. The species concerned are *R. griffithianum*, *R. arboreum*, *R. barbatum* and certain Chinese species, and attack has occurred both under glass and out of doors. The symptoms of attack are wilting and die-back ; silvering of the foliage does not occur. Full details were given by A. D. Cotton in *Gard. Chron.* 77, 1925, p. 112.

The investigations on Silver Leaf at Cambridge by F. T. Brooks have been continued and have yielded interesting results. The latter have been published in the *Ministry's Journal* 32, 1925–26, p. 1128, and, in more detail, in *Jour. Pomol. & Hortic. Sci.* 5, 1926, p. 61. A method of control giving good results in practice was described by F. R. Petherbridge in the latter *Journal* 5, 1926, p. 141. A. W. Exell (*Trans. Brit. Myc. Soc.* 10, 1925, p. 207) has compared the microscopical characters of the spore-bearing layers in the fructifications of *Stereum purpureum*, *S. hirsutum* and *S. sanguinolentum*, and finds *cystidia* in the first-named, but not in the other two. F. Tutin (*Biochem. Jour.* 19, 1925, p. 414) has found that silvered leaves contain an appreciably smaller

amount of pectin than normal leaves. J. K. Mayo (*New Phytol.* 24, 1925, p. 162) has studied *S. purpureum* in regard to its enzymes, and has demonstrated the presence of nine. In foreign countries Silver Leaf disease does not appear to be so common or serious as it is with us. L. Petri (*Boll. d. R. Staz. Pat. Veg.* (Rome) 7, 1927, p. 1) has described a silvering of the foliage and twigs of young peaches in Italy caused, not by *S. purpureum* or other fungus parasite, but by some physiological disturbance due to local environmental conditions. The Ministry's Leaflet No. 302 on Silver Leaf was completely re-written and brought up to date in 1927.

Brown Rot (*Sclerotinia fructigena* Schroet.) was not specifically reported in 1925, but in 1926 was recorded as common in East Anglia and Kent, and as responsible for the greater part of the Brown Rot of fruit at East Malling. In 1927 severe cases were reported from Berks and Middlesex, whilst it was noted in Kent, Somerset and Devon. **Blossom Wilt, Spur Blight, Wither Tip** and **Brown Rot** (*Sclerotinia cinerea* Schroet.) were common in 1925 and 1926, particularly in the northern province, and also in the west and south-west. The amount of fruit lost in East Anglia in 1926 from this form of Brown Rot was exceptionally heavy, whilst severe losses were reported also from Lincs, Worcs. and Sussex. In 1927 these diseases were less prevalent, but severe cases were reported from Lancs, Warwickshire and Cornwall.

An important paper on the world distribution of the species of *Sclerotinia* causing Brown Rot of fruit was published by H. Wormald in *Ann. Bot.* 41, 1927, p. 287.* A. H. Lees and H. R. Briton-Jones have reported the results of a trial to control Brown Rot of plums (together with aphis and winter moth caterpillar) by means of Lime Sulphur, Caustic Washes and Carbo-fluids (*Jour. Pomol. & Hortic. Sci.* 4, 1925, p. 196).

Rust (*Puccinia Pruni-spinosae* Pers.) was frequent and in some cases somewhat severe (on Victorias) both in the Eastern counties and also in Devon and Cornwall in 1925. In the following year it was unusually severe, defoliation of trees being reported from Worcestershire, Herefordshire, Gloucestershire, Surrey and Kent. In 1927 it was general in East Anglia, and was noted on a few trees in Kent and on a wall tree in Hants. The aecidial stage on *Anemone coronaria* was reported twice in 1925 and again in 1926 the affected plants always being near plums with rusted foliage. **Shot Hole,** ascribed (perhaps not always correctly) to *Clasterosporium carpophilum* (Lév.) Aderh., was reported as severe and causing defoliation in Worcs. and Kent, and as common in Lincs in 1925. It was not reported in 1926 and was noted only once in 1927, viz. in South Wales, where it was accompanied by cracking

* Dr. Wormald recorded *Sclerotinia Crataegi* Magn. as new to Britain, on Hawthorn in Kent, in 1926.

of the fruit. The bacterial form of the disease was reported as slight in 1925 in Monmouth and Somerset. In 1926, however, it was very prevalent in the Bristol area and was noted in South Wales. In 1927 the attacks near Bristol were not nearly so pronounced, and it was not reported from other districts.

Scab (*Cladosporium carpophilum* Thüm. = *Fusicladium carpophilum* (Thüm.) Oud.) was recorded on yellow egg plum at Colwall in Worcs. in September, 1925, and at Bromsgrove in the same county in September, 1927, on the same variety. These are the only two records of this fungus received since 1919. **Pocket Plums** (*Taphrina Pruni* (Fuck.) Tul.) were not uncommon in Northumberland in 1925, but were not reported in 1926 or 1927. This disease does not seem to be so prevalent here as on the Continent. **Witches' Brooms** (*Taphrina insititiae* (Sadeb.) Johans.) were frequent around Evesham and reported from Salop in 1926.

Root Rot due to *Armillaria mellea* (Vahl) Fr. caused the loss of many plum trees in Northumberland and Somerset in 1925, and again in the latter county in 1926. *Roesleria hypogaea* Thüm. & Pass. was found on the dead roots of young trees in Somerset in 1927. **Crown Gall** (*Bacterium tumefaciens* E. F. Sm. & Towns.) was reported as injuring some grafted plum stocks in Cheshire in 1927. *Fomes pomaceus* (Pers.) Lloyd was frequently reported as common on old plum trees during the period under review, but its effect upon the host has not yet been fully studied. *F. igniarius* (Linn.) Fr. was recorded on plum in Devon in 1925, whilst in the same county in the following year *Polystictus versicolor* Fr. was found on both still living and already dead parts of moribund trees.

Die Back was common in the eastern counties in 1925, but was not so severe there as in the previous year ; Prince of Wales was the variety largely concerned. Much loss was caused in the northern province in that year from this disease, and it was also reported from Salop. In 1926 cases were reported from Hunts, Worcs., Surrey and Somerset, and in 1927 from Yorks, Notts., Lincs, Worcs. and Suffolk. The cause or causes of the various forms of Die Back are still not thoroughly understood. Fungi such as *Diaporthe perniciosa* March., *Cytospora* sp. and *Sphaeronoma* sp. are not infrequently present, but it is doubtful whether they are always the causative agents of the disease. Bacteria are also sometimes implicated, and their presence may, in some cases at least, perhaps be of primary importance. Reference to Briton-Jones' work has already been made under Apple (*see* p. 44) and an important report on the incidence of Die Back in plum trees by J. Amos, R. G. Hatton and A. D. Mackenzie is to be found in the *Supplement* to the *Ann. Rep.* (13th year) 1925 of the *East Malling Research Station* published in 1927, p. 33.

CHERRY.—Blossom Wilt and **Wither Tip** (*Sclerotinia cinerea* Schroet.) were frequently reported in 1925 ; they were widely

distributed and often noted on Morellos and culinary varieties. In 1926 there were fewer records, and the attacks were less severe, whilst in 1927 these diseases were seldom reported. Flowering spurs of Morello were noted in 1926 in Kent, being killed off by *Botrytis cinerea* before the opening of the flowers. *Sclerotinia fructigena* Schroet. was noted on Morellos in Kent in 1926 causing **Brown Rot.**

Leaf Scorch (*Gnomonia erythrostoma* (Pers.) Auersw.). The perithecia of this fungus were found in 1925 in overwintered leaves in Devon in February, and in Cornwall in March. In 1926 the overwintered leaves on the trees were rather conspicuous in some N. Berkshire orchards in the spring. A bad attack was recorded on Morello in Sussex. In Berks and Bucks, Duke was noted as less attacked than Blackheart, Frogmore, Governor Wood, Caroons and Black Eagle. In 1927 the disease was of little importance. **Leaf Curl** (*Taphrina minor* Sadeb.) was reported as locally common in Salop, Hunts and Devon in 1925. In the following year it was reported from Monmouth, and in 1927 from Suffolk, Berks and South Wales. **Witches' Brooms** (*Taphrina Cerasi* (Fuck.) Sadeb.) were noted in Salop in 1925, in Devon in 1926 and in South Wales in 1927. They are common on wild cherries in parts of Herts. **Shot Hole,** ascribed to *Clasterosporium carpophilum* (Lév.) Aderh., was noted in Durham in Sept., 1926, and in Cumberland in Sept., 1927. Bacterial Shot Hole was reported on young nursery stocks in Hereford in 1925. **Silver Leaf** was noted on this host in 1925 in Devon, Somerset, and the Isle of Ely. The varieties attacked were Morello, Napoleon, Biggareau, Adam's Crownheart and May Duke. In 1926 it was reported from Anglesey, Cambridge, Oxford, Somerset and South Wales on Early Rivers', May Duke and Morello. In 1927 it was reported only from South Wales, on a Double Morello.

Die Back ascribed variously to *Cytospora leucostoma, Diaporthe perniciosa* and *Cytosporina* was reported from Suffolk, Hunts, Kent, Hereford and Gloucester in 1925, Hants in 1926 and Hereford and Kent in 1927.

PEACH, NECTARINE, Etc.—Leaf Curl (*Taphrina deformans* (Berk.) Tul.) was reported in 1925 from Northumberland, Lancs, Norfolk, Glamorgan, Surrey, Sussex and Devon ; in 1926 from Northumberland, Caernarvon, Denbigh, Suffolk, Essex, Monmouth and Somerset. In the last named county it was general and severe. In 1927 it occurred in Northumberland, Yorks, North Wales, East Anglia, Hereford, Worcs., Oxford, Berks, Glamorgan and Devon. It occurred occasionally on flowering Almonds. **Silver Leaf** was reported on Peaches and Nectarines, both out of doors and under glass, a few times in each of the three years. **Mildew** (*Sphaerotheca pannosa* (Wallr.) Lév. var. *persicae* Woron.) occurred on Royal George only, of those varieties under

glass at Wisley in 1925, and on an outdoor tree in Salop. It reappeared on the same tree in 1926 and was reported from Devon in that year. In 1927 it was reported from Essex and Berks. **Shot Hole** (*Clasterosporium carpophilum* (Lév.) Aderh.) was not reported in 1925. An unusually severe attack on Belgrade was noted in Cheshire in 1926 ; Royal George, Barrington, Alexandra, Noblesse and Duchess of Cornwall in the same house were only slightly attacked. In 1927 cases were reported from Northumberland, Cheshire, Norfolk, Salop and Glamorgan. A good account of this disease was published by G. Samuel in *Ann. Bot.* 41, 1927, p. 375. **Scab** (*Cladosporium carpophilum* Thüm.) was noted in Cumberland in 1926 and Northumberland and Yorks in 1927.

It is interesting to record that *Sclerotinia americana* Nort. & Ezek., an American Brown Rot fungus that does not occur in this country, was discovered by Dr. Wormald in 1927 on consignments of peach fruits imported from Georgia (U.S.A.) and Ontario. (*Jour. Min. Agr.* 35, 1928, p. 741.)

On **QUINCE** the powdery **Mildew** (*Podosphaera leucotricha* (Ell. & Everh.) Salm.) was reported from Herts and Surrey in 1925, from Herefordshire, Oxon and Somerset in 1926, and from Herefordshire in 1927. **Leaf Blight** (*Fabraea maculata* Atk.) occurred in Herefordshire and Kent in 1925, in Sussex, Kent and Devon in 1926, and Herts and Sussex in 1927. In some cases severe defoliation occurred.

The occurrence of the Quince **Leaf Blotch** fungus (*Sclerotinia Cydoniae* Schell.) was reported for the first time in Britain by Dr. Wormald in 1925. It was found at East Malling and also (by W. J. Dowson) at Wisley. (See *Trans. Brit. Myc. Soc.* 10, 1926, p. 303, and *Supplement* II, *Ann. Rept.* (13th year) *E. Malling Research Station*, 1927, p. 87.)

GOOSEBERRY.—American Gooseberry Mildew (*Sphaerotheca mors-uvae* (Schw.) Berk.). In 1925 no outbreaks were reported before May, when the Mildew was found in Cambs. and Hunts in the east, Cardiganshire in the extreme west, Worcs. in the Midlands and Somerset and Devon in the south-west. In June, it was reported from Northumberland, Cumberland and North Wales, and during the summer it became widespread. On the whole the attacks were not severe except in the west. In 1926 the winter stage was reported in Jan., Feb. and March from Notts., Surrey and Northumberland respectively. The first outbreak of the summer stage was reported from Worcestershire on March 15th, and during April it was reported from Northumberland, Cambridge, Cardigan, and Gloucester. It was not observed in Cornwall until the second week in May. During the next three months the mildew became epidemic more or less throughout the country, but the amount of spoiled fruit was, on the whole, less than was anticipated early in

the season. In 1927 the first outbreak reported was from Gloucester, in the third week in April. During May it appeared in Cornwall and Devon, Mid and North Wales, Worcestershire and Cambridge ; it was not seen in the north until June (Cumberland), and a late outbreak in the northern province was responsible for considerable damage. The intensity of the disease in 1927 was unusually severe, more so than in the two previous years ; in Gloucestershire varieties like Keepsake and Gunner that are usually resistant there, were severely attacked. Lancashire Lad was reported practically free from Mildew in Kent in October.

Successful experiments in controlling the disease were described by R. M. Nattrass in the *Ministry's Journal*. Vol. 33, 1926-27, p. 265 and p. 1,017, and Vol. 35, 1928-29, p. 161. Excellent work on the control of the Mildew has also been done recently in Northern Ireland by A. E. Muskett and E. Turner. An account of it was published in *Jour. Min. Agric. N.I.* 1, 1927, p. 45. American Gooseberry Mildew was reported on Black Currant in Worcestershire in 1925 and 1926, and in Norfolk and Kent in 1927. It was found on Red Currant in Gloucestershire and Somerset in 1926, and in Cambridge and Norfolk in 1927. It was also found on the " Worcesterberry " (Gooseberry × Black Currant) in a nursery in Flintshire as well as in Worcs., Hants and Kent in 1927. The **European Gooseberry Mildew** (*Microsphaera Grossulariae* (Wallr.) Lév.) was reported each year from a few localities, frequently on old bushes in the shade of trees ; but no material damage accrued.

Cluster Cup Rust (*Puccinia Pringsheimiana* Kleb.) was unusually abundant in 1925, but mainly in the southern counties. It was less frequently noted in 1926, but was abundant and severe in the Penrith district of Cumberland. It was also prevalent in Northumberland and parts of Lancs and Cheshire. In 1927 it was not often reported, but was noted both south and north in slight amount.

Leaf Spot (*Pseudopeziza Ribis* Kleb.) was frequent in Devon in 1925, but did little damage ; it was reported from Worcs. and Kent in 1926 but there were no records for 1927. **Die Back,** due to *Botrytis cinerea* Pers. was more common than usual in the eastern counties in 1925, and a few cases were reported in 1926 and 1927 from various parts of the country. **Coral Spot** (*Nectria cinnabarina* (Tode) Fr.) was reported from Northumberland and Cambridge in 1925 and from Norfolk in 1926. **Silver Leaf** was reported from the Isle of Ely in 1925 and 1926, from Berkshire in 1925 and Cambridge in 1927. *Armillaria mellea* (Vahl) Fr. was responsible for the death of a few bushes in Northumberland and Cornwall in 1925 and Gloucester in 1926, whilst *Rosellinia necatrix* (Hart.) Berl. was recorded on the roots of a bush in Devon in the latter year.

BLACK CURRANT.—Reversion, and its associated trouble " Big Bud," has become the most serious disease of this crop. It

occurs all over the country wherever Black Currants are grown and generally in considerable amount. The research work that has been in progress for some time, particularly at Long Ashton and East Malling, has now led to the view that the disease is of the Virus type and that the Big Bud mite is a carrier. A full account of the matter is given in the Ministry's Leaflet No. 377 which was thoroughly revised in December, 1927. The most important original papers are by A. H. Lees in *Ann. Rept. Long Ashton Res. Station* for 1925, p. 66, and *Ann.* Appl. *Biol.* 12, 1925, p. 199 ; by J. Amos, R. G. Hatton, R. C. Knight and A. M. Massee in *E. Malling* 13*th Ann. Rep.* 1927, (*Supplement*) p. 126 ; by J. Amos and R. G. Hatton in *Jour. Pomol. and Hortic. Sci.* 6, 1927, p. 167 and by R. C. Knight in *E. Malling* 13*th Ann. Rep.* 1927, (*Supplement*) p. 70. C. D. Darlington (*Jour. Pomol. and Hort. Sci.* 6, 1927, p. 242) has shown that Reversion cannot be due to the loss or gain of a whole chromosome and cannot be regarded as a genetic mutation.

Foliage symptoms strongly suggestive of a **Mosaic** disease were reported on reverted bushes in Cheshire in 1925 and 1926. A voluntary scheme for the inspection and certification of healthy stocks of Black Currants is now in operation and will doubtless lead to much improvement, since the distribution of reverted bushes and cuttings that has been so prevalent in the past is bound to diminish.

Rust (*Cronartium ribicola* Dietr.) was reported twice only in 1925, viz. from Berks and Surrey, in September and October respectively. During these months in 1926, however, this Rust was reported from Durham, Yorks, Suffolk, Hereford, Worcs., Berks, Kent, Hants and Sussex. In some cases the infection was heavy. In 1927 one case only was reported, viz. from Norfolk, in September. In most cases the alternate host (White Pine) was not observed in the locality. **Leaf Spot** due to *Pseudopeziza Ribis* Kleb. was frequent in Devon and rather severe in Cornwall in 1925, and was also reported from Suffolk and Kent as the cause of serious defoliation. Three cases were noted in 1926 from Suffolk, Berks and Devon respectively. In 1927 the disease was more widespread, being reported from Northumberland, Lancs, Norfolk, Worcs., Hereford, Sussex, Kent and Berks. H. R. Briton-Jones has recommended hard pruning and liberal manuring as measures of control for this disease. (*Ann. Rep. Long Ashton Research Station* for 1925, p. 105.) **Black Pustule** (*Plowrightia ribesia* (Pers.) Sacc.) was noted on a few old bushes in South Wales in 1925, and *Armillaria mellea* (Vahl) Fr. caused the death of several bushes on the site of an old hedgerow in Worcestershire in that year.

RED AND WHITE CURRANTS.—Defoliation associated with **Leaf Spot** (*Pseudopeziza Ribis* Kleb.) was reported on white varieties

in Herefordshire in 1926, red varieties alongside being less affected. Defoliation of red varieties from the same cause, however, was noted in Berks and in Devon in 1927. **Silver Leaf** was reported in old bushes from Northants and the Isle of Ely in 1925, from Gloucestershire in 1926 and from Worcs. and Somerset in 1927. In bushes adjoining reverted Black Currants **Reversion** appeared to be present in one locality in Cumberland in 1926. What looked like a **Mosaic** disease in Red Currant was reported as being very prevalent in East Anglia in July, 1927.

RASPBERRY.—Mosaic, probably a disease of the virus type, was reported in 1925 from Northumberland, Durham, Lancs, Cheshire, Lincs, Notts., South Wales and Somerset. It occurred most frequently in Superlative, but was also seen in Baumforth's Seedling, Bath's Perfection, and Falstaff. In 1926 it was observed in Yorkshire (where it was very severe on Superlative), Worcs. (Semper Fidelis), Somerset (Superlative) and Devon. In 1927 it was reported only from Yorks, Hereford and Berks. The disease is under investigation at East Malling, where it has been proved to be transmissible by grafting. Experiments on transmission by other means are in progress.

Blue Stripe Wilt (*Verticillium Dahliae* Kleb.).—This disease is new to the present series of Reports. It has probably been in the country for some little time, but has only recently emerged as a result of the special attention now being given to Raspberry diseases at the East Malling Research Station. A full account of the disease was given by R. V. Harris in *Jour. Pomol. & Hortic. Sci.* 4, 1925, p. 221. It was reported in 1925 from Yorkshire, Worcs., Cambridge, Herts, South Wales, Kent and Devon ; and in 1926 from the Midland Province. No records of it were received in 1927.

Anthracnose (or " Cane Spot ") caused by *Plectodiscella veneta* Burkh. (*Gloeosporium venetum* Speg.) is also new and has been segregated as the result of recent work at East Malling. In 1925 it was recognized only in Kent, on Baumforth B. and Wisbech Wonder. In 1926 it was reported from Worcs. and Somerset. In the latter county Lloyd George was severely attacked, whilst adjacent Pyne's Royal was scarcely affected. In 1927 it was observed in Cambridge, Oxford and Sussex. As the symptoms become better known the disease will probably be recognized over wider areas. It was observed on Loganberry in Hants and Berks in 1926 and 1927 and also in Wilts. in the latter year.

Spur Blight (*Didymella applanata* (Niessl) Sacc.) was reported as being general in the Cambridge area in 1925, and also in parts of Somerset. In the following year it was abundant in Northumberland on Pyne's Royal, Fillbasket and Fell's Monarch, and was also reported from Worcs. (on Norwich Wonder) and from the Bristol Province. In 1927 it was noted in Northumberland, Durham

Yorks, Salop, War., Worcs. and Cambridge. Occasionally the damage done was serious. It was noted on Loganberry in Gloucester in 1927. **Rust** (*Phragmidium Rubi-Idaei* (Pers.) Karst.) was fairly general at East Malling, Kent, in 1925, and was reported from Lincs. and Caernarvon in 1926 and from Wilts. in 1927. The disease is seldom serious, but it was very common on Loganberry in one locality in Devon in 1926. **Mildew** (*Sphaerotheca Humuli* (DC.) Burr.) was noted as rather severe in some localities in Cheshire, and occurred in Somerset, in 1927. *Botrytis* was found at East Malling in 1927 in circumstances suggestive of its being the cause of the death of canes of Lloyd George.

Crown Gall (*Bacterium tumefaciens* E. F. Sm. & Towns.).—Aerial galls on the canes were reported from Cheshire in 1926 and from Durham and London in 1927. The disease was also reported on Loganberry in Hants in 1926 and on the roots of imported plants in Kent in 1927. It was also found on about 10 per cent. of the canes in a small area of cultivated Blackberries in Hants in 1926.

Hendersonia Rubi Sacc. was noted on Raspberries in Somerset and Devon and also on Blackberry in the former county in 1925, whilst *Leptosphaeria Coniothyrium* Sacc. was reported from Oxford in 1926 and Yorks in 1927. In 1925 there were a good many complaints of failure of raspberries in the Bristol Province, the trouble frequently taking the form of a "Crown Rot." *Diaporthe perniciosa* March. was frequently isolated from diseased crowns, but other fungi were also present on both the under- and over-ground parts of the plants, and the trouble may have been due partially to excessive soil moisture. *Diaporthe* was also isolated from diseased parts of the current year's canes of Blackberry in Gloucester in 1926. *Nectria Rubi* Osterw. was met with (also in Lancs) occasionally, but the parasitism of this fungus still remains doubtful (G. H. Pethybridge and R. M. Nattrass, *Trans. Brit. Mycol. Soc.* 12, 1927, p. 20). *Septoria Rubi* West. was reported on wild Blackberry leaves in Somerset in 1926 and was thought to be the probable cause of a Leaf Spot of the cultivated Bramble in Kent in the same year. *Cytosporina ramealis* (Desm. & Rob.) Petrak caused considerable damage to the canes of the cultivated Blackberry in Middlesex in 1926, whilst *Cercospora Rubi* Thüm. was found on wild Bramble in Sussex in that year.

STRAWBERRY.—Mildew (*Sphaerotheca Humuli* (DC.) Burr.) was reported in 1925 from Northumberland, Lincs, Norfolk and the Isle of Ely. Paxton's and Madam Kooi were the varieties attacked. In the Bristol area Ruskin was reported as more susceptible to Mildew than most other varieties. In 1926 it was present again in Northumberland, as well as in Berks and Somerset. In 1927 it was slight in Berks, and fairly common in the Tamar Valley in Cornwall. Of the two **Leaf Spots,** that caused

by *Mycosphaerella Fragariae* (Tul.) Lindau was the more prevalent. In 1925 it was common but not severe, as a rule, in Northumberland ; it was also reported from Cheshire (where it was bad on Marshal Foch), Salop, and Glos. ; in the last-named county the autumn growth of planted out runners of Royal Sovereign at Cheltenham was severely impaired. It was again prevalent in Northumberland in 1926, and was very severe in Yorks on Royal Sovereign, as well as in Salop, on different varieties. In 1927 the disease was again severe in several districts, e.g. the Northern Province, Cheshire, Worcs. and Glos. ; it was also reported from Cambs., Glamorgan, Monmouth, Hants and Kent. **Leaf Scorch**, due to *Marssonina Fragariae* (Sacc.) Kleb., the perfect stage of which is *Diplocarpon Earliana* (Ell. & Everh.) Wolf, was much less common, being reported in 1925 only from Glos., in 1926 from Cumberland, and in 1927 from Cheshire and Suffolk. *Didymella Lycopersici* Kleb. was reported in 1925 as being responsible for the loss of strawberry plants under glass at Cheshunt, Herts. Notes on the disease by T. Small are to be found in the 11th, 12th and 13th *Annual Reports* of the *Experimental and Research Station, Cheshunt*, pp. 85, 38 and 45 respectively.

The congeries of diseases known under the names of **Red Plant, Cauliflower, Patch,** etc., continued to be the subject of investigation, with headquarters at the Long Ashton Research Station. Studies on the root and shoot growth of the normal strawberry plant were published by C. E. T. Mann and E. Ball in *Jour. Pomol. & Hortic. Science* 5, 1926, p. 149, whilst an account of the Long Ashton investigations on the diseases in question was given by these two authors and L. N. Staniland in the *Jour. Min. Agric.* 34, 1927/28, p. 497 and p. 627.

GRAPE VINE.—Downy Mildew (*Plasmopara viticola* (Berk. & Curt.) Berl. & de Toni) was discovered on an outdoor vine at Wye, Kent, in August, 1926. This is a very rare event. The mildew was first recorded in England in 1894, and the occurrence in 1926 was its second appearance. During the thirty-two years' interval the mildew has not been seen in this country. The affected vine was cut down and burnt. An account of the outbreak was published by R. M. Harrison and W. M. Ware in *Gard. Chron*, 80, 1926, p. 448.

The ordinary **Powdery Mildew** (*Uncinula necator* (Schw.) Burr.) was reported in 1925 on vines under glass from Cambridge, South Wales, Somerset and Devon. In 1926 it was noted in Lancs and Cheshire, Denbigh, Salop, Northants, Staffs, East Anglia, London, Kent, Hereford and Somerset. In 1927 it occurred in Denbigh, Lincs, Essex, London, Wilts. and Devon. *Botrytis* affecting the leaves and in some cases the fruit also, was reported in 1926 from Bucks and Somerset, and in 1927 from the latter county.

FIG.—Canker (*Phomopsis cinerascens* (Sacc.) Trav.). This fungus was found in 1925 in abundance on " snags " left after trimming two trees near Reading. Undoubted, typical " b "-spores were found for the first time in this country in this material ; but the fungus made no progress beyond the snags, and the trees remained otherwise sound. In 1926 the fungus was found causing cankers in living wood in Bucks, and in 1927 one badly affected tree was noted in Pembrokeshire. *Botrytis* was reported as affecting the young shoots and fruit under glass in Northumberland in 1926 and 1927, and one case of the destruction of the fruit by this fungus was noted in the Midland Province in the former year. An undetermined species of Gloeosporium was also found in 1926 to be affecting young shoots under glass in Northumberland.

Gnomonia leptostyla (Fr.) Ces. & de Not. (*Marssonina Juglandis* (Lib.) Magn.) was noted as causing a leaf blotch of **WALNUT** in north Somerset in 1926, and early defoliation of a large tree in Devon in 1926. It was also noted in Kent in the same year. A similar disease associated with a species of Marssonina having larger spores than the corresponding stage of the above fungus was noted in the Bristol Province in 1927, where it appears to be not uncommon.

The Fusarium stage (*F. lateritium*) of the **MULBERRY Canker** fungus (*Gibberella moricola* (de Not.) Sacc.) was noted in Hants in 1926 and identified at the East Malling Research Station.

A stem-rot of **MELON,** probably of a bacterial nature, and affecting mature plants, was reported from one locality in Salop in 1925, whilst Verticillium wilt, (*V. albo-atrum* Reinke & Berth.), was reported as slight in one case in Essex in 1926.

DISEASES OF HOPS AND FLAX.

HOP.—Powdery Mildew or "Mould" (*Sphaerotheca Humuli* (DC.) Burr.) occurs to a greater or less extent in our hop gardens and yards every year, its intensity varying with the season. In 1925 it was reported on cultivated hops only once, viz. from Hants, in August; but it was noted in abundance on wild hops in South Wales in that year. In 1926, on the other hand, this mildew caused serious damage in Kentish hop gardens, the attack on the "cones" being the most severe experienced for several years. Some acres of hops in that county were left unpicked owing to the mildew. In the west midlands the attack was general, but was satisfactorily controlled by sulphuring. In 1927 there were no special complaints. In connexion with resistance to Powdery Mildew, E. S. Salmon and W. M. Ware have found (*Ann. Appl. Biol.* 14, 1927, pp. 276-289) that scions of susceptibles grafted on immune stocks remain susceptible, and *vice versa*, showing that it is unlikely that immunity is due to any substance translocatable in the plant. The results agree with those of Roach with Wart Disease of the Potato (*see* p. 18).

Downy Mildew (*Pseudoperonospora Humuli* (Miy. & Tak.) Wilson), first noted in England in a single locality in 1920, became more widespread during the three-year period under review. In 1925 it occurred in a considerable number of hop gardens in various districts in Kent, attack on the "cones" being reported in some cases. It was also found in Hants and Worcs. It was observed on wild hops in Kent, and also in Essex and Devonshire; in the two latter counties hops are not cultivated. In 1926 Downy Mildew again appeared on the "cones" of hops in Kent, but the damage done was very slight, and was far outweighed by attacks of the ordinary Powdery Mildew, which, as stated above, was very prevalent in that year. It was also reported from Hants and Sussex, and in the latter county it was found on wild hops. In 1927 an increased number of records of the disease was received. It was found on cultivated hops in Herefordshire Worcs, Berks, Hants, Sussex, Kent and Surrey. In most of these counties it was also found on wild hops; in addition it was recorded on wild hops in Norfolk, Herts, Wilts. and Gloucester, counties in which hops are not cultivated. As to the amount of damage done, this is difficult to estimate with accuracy. It was not in general "catastrophic," nevertheless in a number of instances, particularly in Kent, considerable losses (sometimes reaching 25 per cent. of the crop) were sustained. Owing to Downy Mildew the crop in many instances had to be picked a week or two earlier than usual, and the consequent loss in weight and reduction in quality for brewing purposes were often considerable.

The experience of the three years confirmed the view that this new disease has come to stay; like the potato Blight and other

diseases due to Downy Mildews, it is likely to occur in epidemic form in wet seasons, and will have to be controlled by measures analogous to those at present in vogue for such diseases. So far, the variety Fuggles has been less attacked (particularly on the " cones ") than varieties such as Tolhurst, Bramling and Prolific.

It is interesting to note that this new disease has descended not alone on Britain but also, more or less simultaneously, on many countries on the European Continent. Thus, it was found in Germany in 1924, and in France, Belgium and Russia in 1925. In 1926 it occurred in Holland, Czecho-Slovakia, Austria, Hungary, Roumania, Jugo-Slavia, Sweden and Italy. It was stated in 1926 to have been present in Serbia as long ago as 1894, but that no attention was paid to it then. A Downy Mildew occurring on Hemp in that country is said strongly to resemble that of the Hop. In 1927 it was recorded from Poland and Latvia.

The early history of the disease, with its literature, was dealt with in the previous Report (Miscellaneous Publications No. 52, 1926, pp. 83 & 84), and the following are the chief publications that have appeared in this country since then :—E. S. Salmon & W. M. Ware.—" The Downy Mildew of Hops and its epidemic occurrence in 1924 " *Ann. Appl. Biology*, 12. 1925, pp. 121-151 ; Eidem " The Downy Mildew of the Hop " *Jour. Min. Agri.* 31, 1924-25, p. 1144, and 32, 1925-26, p. 30 ; Eidem " The Downy Mildew or Spike Disease of the Hop in 1925 " *ib.* 33, 1926-27, p. 149. Eidem " The Downy Mildew of the Hop in 1926 " *ib.* p. 1108. Eidem " On the Presence of a Perennial Mycelium in *Pseudoperonospora Humuli*," *Nature*, 116, 1925, p. 134. Eidem " The Downy Mildew of the Hop " *Dept. of Economic Mycology, S.E. Agric. Coll. Wye, Kent*, 1927. W. M. Ware.—" *Pseudoperonospora Humuli* and its mycelial Invasion of the Host Plant " *Trans. Brit. Myc. Soc.* 11, 1926, p. 91. References to the chief foreign literature will be found in the above papers.

A severe attack of Hop **Canker,** due to a species of *Fusarium*, was reported in Kent in 1925, whilst several cases were observed in the same year in Hereford and Worcs., the affected " hills " being mostly in low-lying wet situations. A species of *Gibberella* was observed on the base of an old dried up bine in one instance. In 1927 this disease was reported as being worse than usual in Hants, but it was not reported from other districts. Two cases of **Wilt** were observed in 1926. In one, in Kent, it was associated with a species of *Verticillium* ; in the other, in Sussex, with a species of *Phoma*. *Botrytis cinerea* occasionally attacked hop " cones " and leaves in Kent in 1924, '25, and '26, (H. Wormald and W. F. Cheal, *Jour. Min. Agric.* 33, 1926-27, p. 456), whilst a species of *Ascochyta* was observed associated with leaf-spots on wild hops in that county in 1926. *Cercospora cantuariensis* Salm. & Worm. was noted sparingly in the Reading Province in 1927.

Nettlehead was reported from Kent, Hereford and Worcs. in 1925 and from Hereford in 1926. In 1927, in Kent, it was observed that the variety Fuggles, when suffering from Nettlehead, was much more severely attacked by Downy Mildew, both on leaf and cone, than when free from Nettlehead. The long period of silence concerning the nature and cause of this disease was broken in 1925 by the publication of a paper by C. A. W. Duffield (*Ann. Appl. Biol.* 12, 1925, p. 536). From the observations of this author it would appear that true Nettlehead must be distinguished from false Nettlehead, and that the former cannot, as was once done, be regarded as being caused by the eelworm *Heterodera schachtii*. The idea is put forward that the disease is transmitted by Aphides and also by the knife in spring. This suggests that the disease may be one of the virus type.

No specific records of the incidence of **Mosaic** in Hops were received during the three years under review, and the importance of this disease in hop gardens has yet to be gauged accurately, although there can already be little doubt that it is significant and increasing. Attention was first called to the disease by E. S. Salmon in 1923 (*Jour. Min. Agric.* 29, 1922-23, p. 927) and a three years' field study of the disease by W. F. Cheal in certain selected gardens in Kent was concluded in 1925. The results showed that the disease appeared to be of an "infectious" nature, and that although it could not be eradicated totally by two years roguing, yet its intensity and spread could be kept well in check by this means. There was some evidence showing the possibility of introducing the disease into a healthy garden through hop plants that showed no symptoms of the disease. E. S. Salmon and W. M. Ware (*Gard. Chron.* 77, 1925, p. 320) showed that grafting of hops was possible, and T. C. Thrupp (*Ann. Appl. Biol.* 14, 1927, p. 175) showed that Mosaic symptoms in hops can be transmitted by grafting and also that "carriers" exist, *i.e.*, plants showing no symptoms of Mosaic themselves, but capable of causing such symptoms to appear in healthy scions of susceptible varieties grafted upon them. A Miscellaneous Publication (No. 42) entitled "Cultivation, Diseases and Insect Pests of the Hop Crop" was issued by the Ministry in 1925.*

FLAX is cultivated only to a very slight extent in England and Wales, and no complaints of disease arose during 1925-1927. The oidium stage of a powdery **Mildew** occurred under glass in 1927 on flax plants grown by Dr. A. W. Henry in Cambridge in connexion with his studies on Rust resistance in Flax. This was tentatively identified as *Erysiphe Polygoni* DC. by E. S. Salmon & W. M. Ware (*Gard. Chron.* 82, 1927, p. 34).

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* Obtainable from the Ministry at 10, Whitehall Place, London, S.W. 1, price 2s. 6d. net, post free.

DISEASES OF ORNAMENTAL AND OTHER PLANTS.

Grey Mould (*Botrytis*) caused damage to **Anemone** flowers in the Isles of Scilly in 1926, and **Rust** (*Puccinia Pruni-spinosae* Pers.) was noted occasionally on *A. Coronaria*. In 1927 it was found on *A. fulgens* in Cornwall. *Botrytis Paeoniae* Oud. was common in Lincs on **PAEONY** in the spring of 1925, and was reported from Surrey in 1926. *B. cinerea* attacked flower buds in Surrey in 1926 and the same trouble occurred in Devon in 1927. On **DELPHINIUM** the **Powdery Mildew** *Erysiphe Polygoni* DC. was common on old plants in Staffs in 1926, and **Black Blotch** (*Bacterium Delphinii* Bryan) attacked seedlings in Bucks in 1926, and killed off plants in the Reading Province in 1927.

White Blister (*Cystopus candidus* (Pers.) de Bary) was reported as doing damage in 1925 to **ALYSSUM** in Surrey and to **CHEIRANTHUS** in Lincs. In 1926 it was reported in Devon on **ARABIS** and in 1927 on *Arabis* and *Cheiranthus*. Other diseases of Wallflowers (*Cheiranthus*) were **Crown Gall** in Cheshire in 1927, **Finger and Toe** in Staffs in 1926, **Downy Mildew** (*Peronospora parasitica* (Pers.) Tul.) in Kent in 1925, Bucks in 1926 and Devon in 1927. *Botrytis* on this host was more troublesome than usual in Bucks in 1926, and was reported from South Wales in the same year. In 1927 it occurred again in Bucks. On **STOCKS** (*Matthiola*) **Foot Rot** due to *Phytophthora cryptogea* Pethybr. & Laff. was troublesome in seedlings in Northumberland in 1927, *Sclerotinia Sclerotiorum* (Lib.) de Bary also being concerned. In Beds, in the same year, **Downy Mildew** (*Peronospora parasitica* (Pers.) Tul.) was severe in one nursery on this host.

On **VIOLA** and **PANSY** the following were reported during 1927 :—a species of *Oidium* in Cheshire, **Root Rot,** due to *Pythium* sp., and **Black Root Rot,** caused by *Thielavia basicola* Zopf, in Yorkshire. **Rust** (*Puccinia aegra* Grove) was severe in one case in Wales and common in Devon in 1926. It was also noted in Yorks, Cheshire, Herts and Monmouth in 1925, and in Somerset, both in that year and again in 1927. On **VIOLET** (*V. odorata*), **Smut** (*Urocystis Violae* (Sow.) Fisch. v. Waldh.), was severe in Herts in 1925, and cases occurred in that year in Somerset and in 1927 in Hants. **White Spot** (*Ramularia lactea* (Desm.) Sacc.) was severe in Devon in 1926, and attack by *Phyllosticta Violae* Desm. was reported from Salop in 1927.

On **CARNATION** and **PINK** (*Dianthus Caryophyllus*) **Damping Off** caused some loss in Northumberland in 1927, whilst **Wilt,** due to a species of *Fusarium*, was severe in Northumberland, Yorks and Essex in 1925. In the following year it was reported from Essex and Somerset, whilst in 1927 a number of cases occurred in Northumberland, Cheshire, Middlesex and Gloucestershire.

Rust (*Uromyces Dianthi* (Pers.) Niessl) was prevalent in Essex in 1925, and severe in Denbigh in 1926. It was also severe in Cheshire, in 1927, but on "Enchantress" only. Slight cases were reported from other localities. **Ring Spot** (*Heterosporium echinulatum* (Berk.) Cooke) was severe in Cheshire and Yorks in 1927. It was also reported from Northumberland in 1925, from Sussex in 1926 and from Cumberland and Hants in 1927.

Leaf Rot, a disease of Carnations new to this country, was received at the Plant Pathological Laboratory from Prof. Salmon in Jan., 1927, and was recognized as that due to *Pseudodiscosia Dianthi* Hösterm. & Laub. described as a new genus and species by these authors in Germany in 1921. (*Gartenwelt* 25, 1921, p. 65). The specimens came from near Brighton in Sussex. An exhaustive account of the disease was published by E. S. Salmon and W. M. Ware in *Gard. Chron.* 81, 1927, p. 196 and p. 216. It also occurs in Holland, where it was at first tentatively ascribed to a *Septogloeum* (*Versl. en Meded. Plantenziek. Dienst* 41, 1925, p. 19), but later (*ib.* 51, 1928, p. 36) to the correct parasite. The disease was again reported in June, 1927, from Bucklebury, Berks by W. Buddin on Pinks, but no substantial damage was apparent.

Alternaria Dianthi Stev. & Hall was unusually severe on Carnations in Cheshire in 1927, whilst a different but unidentified species of this genus was reported from Cheshunt in 1926. **Leaf Spot** (*Septoria Dianthi* Desm.) was reported from Cheshire and Hants in 1927, whilst in the same year *Botrytis cinerea* caused rotting of blooms in Kent.

On **SWEET WILLIAM** (*Dianthus barbatus*), **Rust** (*Puccinia Lychnidearum* Link f. *Dianthi* Grove) was noted in the Reading province in 1926, and in London and Devon in 1927; while *Ascochyta Dianthi* Lib. was severe in Dorset in 1926, and in Devon in 1926. **Leaf Spot** (*Heterosporium echinulatum* (Berk.) Cooke was serious on this host in Northumberland in 1926, and was noted in a Devon garden in 1927, where it appears every year, and where Bordeaux mixture has failed to control it.

Rust (*Puccinia Malvacearum* Mont.) of **HOLLYHOCK** is still common in gardens, but is not often specially reported. It was, however, reported from Kent in 1925, Salop in 1926 and Devon (severe) in 1927.

Black Leg of **PELARGONIUMS** (Zonal) was responsible for losses in cuttings in the Birmingham area and in Salop in 1925, and in Northumberland in 1926. As was pointed out in the previous Report (p. 89), this disease is sometimes due to Botrytis but also sometimes to Pythium. In one of the cases that occurred in 1926, in Northumberland, however, where a 10 per cent. loss of cuttings was experienced, the parasite concerned appeared to be a species of Phytophthora.

Amongst **SWEET PEAS, Streak** disease, ascribed to *Bacillus Lathyri* Manns & Taubenh., was severe in Cambridge and Leicestershire in 1925, and in Lancs and Cheshire in 1927. Less severe attacks were also reported during the three-year period from other districts. A severe attack of **Downy Mildew** (*Peronospora Viciae* (Berk.) de Bary) was experienced in Worcs. in 1926, whilst **Damping Off** (*Pythium* sp.) caused losses of seedlings in Salop in 1925. **White Mould** (*Cladosporium album* Dowson) was severe under glass in Essex in 1926. This disease and its parasite were first described by W. J. Dowson in 1924 (*Jour. R. Hort. Soc.* 49, 1924, p. 211), but the disease was evidently present in Holland in 1920, although the identity of the parasite was not established until later (*Vers. o.d. Werkzaam. v.d. Plantenziek. Dienst. Jaaren*, 1920 and 1921, *Wageningen* 1922, p. 23, and *ib. Jaar* 1926, *Wageningen* 1928, p. 31). Under the name " White Blight " the disease has recently been described in the U.S.A., where it also occurs. The perfect stage of the fungus (an Ascomycete) was obtained and named by G. H. Martin & V. K. Charles *Erostrotheca multiformis* (*Phytopathology* 18, 1928, p. 839).

On **ROSE, Crown Gall** (*Bacterium tumefaciens* E. F. Sm. & Towns.) was reported occasionally during the period under review on the roots and bases of Manetti stocks, but it appears to be rather less prevalent than formerly. **Black Spot** (*Diplocarpon Rosae* Wolf) was recorded as causing defoliation and severe damage, especially in Oxfordshire, in 1925 and 1927, in the West of England in 1925, and in the Reading Province (on " Juliet " only) in 1927. The imperfect (*Actinonema*) stage alone of this fungus has been noted up to the present in this country. **Mildew** (*Sphaerotheca pannosa* (Wallr.) Lév.) was commonly reported from all provinces and was often severe, whilst **Rust** (*Phragmidium mucronatum* (Pers.) Schlecht.) was as widely distributed although not severe, except in one instance in Northumberland in 1926. One or two consignments of rose stocks dispatched from Holland to this country in that year were so badly attacked by Rust that their entry and distribution had to be prohibited. **Stem Canker** (*Coniothyrium Fuckelii* Sacc.) was reported from Yorks and Essex in 1925, and Salop in 1927. What appeared to be a case of the American **Rose Graft Disease,** due to *Coniothyrium Rosarum* Cooke & Harkn., caused serious trouble in a Herts nursery in the spring of 1927. It was probably introduced on scions which the nursery had imported from the U.S.A., in which country the disease was first described (I. H. Vogel, in *Phytopathology* 9, 1919, p. 403). Other fungi reported (chiefly in 1925) as attacking the rose were *Cryptosporium minimum* Laub. and *Phomopsis incarcerata* v. Höhn. in Berks, and *Septoria Rosae* Desm. in Kent.

On **ASTERS** (*Callistephus*), **Foot Rot** (*Phytophthora cryptogea* Pethybr. & Laff.) was serious in 1925 in Derby and Rutland, and

in 1926 in Cumberland and Devon ; less severe attacks were reported from several other counties. In Northumberland in 1925, *Corticium Solani* Bourd. & Galz. was the cause of a similar disease. **Black Root Rot** (*Thielavia basicola* Zopf) was reported on this host in Lancs in 1926.

On **CHRYSANTHEMUM**, **Crown Gall** (*Bacterium tumefaciens* E. F. Sm. & Towns.) was noted in Cheshire in 1927, whilst **Rust** (*Puccinia Chrysanthemi* Roze) was noted in Devon in 1925, 1926, and 1927, and at least once during this period from each of seven other counties. Severe cases of **Mildew** (*Oidium Chrysanthemi* Rabenh.) were noted in South Wales in 1925, and in Berks in 1926. Slighter cases were also reported from most of the provinces. A leaf blotch (*Septoria* sp.) was severe in Lancs in 1925, and was reported also from Berks. In 1926 it occurred in Kent, and in 1927 in that county and also in Cheshire. For an account of the species of *Septoria* occurring in the cultivated Chrysanthemum the paper by Hemmi and Nakamura should be consulted (*Mem. Coll. Agric. Kyoto Imp. Univ.* No. 3, 1927, p. 1). **Grey Mould** (*Botrytis cinerea* Pers.) was noted as troublesome on the foliage in 1927 in Essex, Berks, Devon and Somerset ; and in Kent on the blooms.

CINERARIA Rust (*Coleosporium Senecionis* Fr.) was noted in Surrey and South Wales in 1925, and a **Wilt** due to *Phytophthora cryptogea* Pethybr. & Laff. was reported from Yorks in 1927.

On **MICHAELMAS DAISY** (*Aster*) **Mildew** (*Erysiphe Cichoracearum* DC.) was noted in Devon and Flint in 1926, whilst **Black Root Rot** (*Thielavia basicola* Zopf) was responsible for the death of plants at flowering time in Cheshire in 1926. **Wilt,** due to *Verticillium Vilmorinii* Westerd. & V. Luijk, was noted at Cheshunt in 1925, in Staffs in 1926 and 1927, and in Berks in 1927. In the previous Report (p. 86) this disease was ascribed to *Cephalosporium Asteris* Dowson, but since its publication, work in Holland has shown that Dowson's fungus is the species of Verticillium mentioned above. (Westerdijk & V. Luijk, *Med. Phytopath. Lab. Baarn* 8, 1924, p. 48 ; abst. in *Rev. Appl. Myc.* 4, 1925, p. 289).

Septoria Leucanthemi Sacc. & Speg. was reported for the first time in this country in 1925. It was causing a **Leaf Blotch** of **SHASTA DAISY,** in Kent and Hants (H. Wormald, *Gard. Chron.* 78, 1925, p. 353). It was again reported from Kent in 1926.

CAMPANULAS, attacked by *Sclerotinia Sclerotiorum* (Lib.) de Bary in a nursery bed, were observed in Northumberland in 1926, whilst **Rust** (*Coleosporium Campanulae* (Pers.) Lév.) was severe in Norfolk and Cambs in 1925 and in Bucks in 1927.

Armillaria mellea (Vahl) Fr. was found attacking the roots of **STATICE** in 1926 in a Devon garden in which it had, in previous years, been responsible for the death of a number of shrubs and fruit trees.

PRIMULAS were killed in 1926 in a nursery in Staffs by *Thielavia basicola* Zopf, and in the same year **Foot Rot,** caused by a *Pythium* was reported amongst seedlings in Northumberland.

Septoria Drummondii Ell. & Everh. was severe on **PHLOX** in Berks in 1925, in Cumberland in 1926, and was reported from Durham, Bucks and Berks in 1927.

Spotting of the leaves accompanied by serious defoliation occurred on a large scale in **STAR CAPSICUM** (*Solanum capsicastrum*) in a Middlesex nursery in 1925. A species of *Phytophthora* (not *P. infestans*) was the cause. The attack was favoured by humid conditions and overcrowding of the plants, and ceased when these were improved.

On **ANTIRRHINUM, Shot Hole** (*Heteropatella Antirrhini* Budd. & Wakef.) was severe at Reading in 1925 and was noted also in Kent. In 1926 the *Cercosporella* stage of the parasite was not seen, but the Heteropatella stage was abundant on the remains of the previous season's plants. In 1927 the disease was reported from Bucks, Surrey, Oxon and Wilts. An account of the life-history of this fungus, including the *Cercosporella* stage, and a full description of it as a new species was published by W. Buddin & Miss E. M. Wakefield in *Trans. Brit. Myc. Soc.* 11, 1926, pp. 169-188. **Stem Rot** (*Phyllosticta Antirrhini* Syd.) was severe in one case in N. Wales in 1925, while **Damping Off** (*Corticium Solani* Bourd. & Galz.) was frequent in seedlings at Reading in that year. **Wilt,** due to a *Verticillium*, (probably *V. Dahliae* Kleb.) was reported from Reading in 1925, whilst a similar disease caused by a species of *Fusarium* was noted in Hants in 1927. **Grey Mould** (*Botrytis cinerea* Pers.) caused losses in seedlings in Berks in 1926 and 1927, while *Diplodina Passerinii* Allesch. was noted in 1926 in Bucks and in 1927 in Surrey. An account of a Blossom Wilt and Stem Rot of this plant (and of **SCHIZANTHUS**) caused by *Sclerotinia Sclerotiorum* (Lib.) de Bary was given by W. J. Dowson in *Jour. R. Hort. Soc.* 51, 1926, pp. 252-265. It was considered probable that floral infection occurred by means of ascospores carried by bumble bees.

The **Gall** on **AZALEA,** due to *Exobasidium Vaccinii* (Fuck.) Woron., has been noted fairly frequently, particularly on plants imported from the Continent. **Leaf Scorch** (*Septoria Azaleae* Vogl.) was recorded in 1927 for the first time in this country, in Kent, on Azaleas imported from Belgium in 1926.

Pestalozzia Hartigii Tüb., causing the **Strangling Disease** of certain **CONIFERS,** occurred in Surrey in 1927 on young plants of *Cupressus Allumii*, causing their death. *Keithia thujina* Durand was severe on *Thuja Lobbii* in some nurseries in Surrey, Hants and Dorset in 1926, and was reported from South Wales in 1927. R. Maire suggests (*Bull. Soc. Hist. Nat. Afrique du Nord.*

18, 1927, p. 117) that, since the generic name *Keithia* is invalid for a genus of fungi, having previously been used for a phanerogamic one, the fungal species of *Keithia* should be transferred to the genus *Didymascella*.

Shab disease (*Phoma Lavandulae* Gab.) continued to be serious in certain **LAVENDER** plantations, and has been the subject of special investigation. *Septoria Lavandulae* Desm. was reported in slight amount in Herts in 1925, causing **Leaf Spot.**

Complaints of **Canker** in **WILLOWS** (*Physalospora Miyabeana* Fukushi) arose in Pembroke and Hants in 1925, in Somerset in 1926, and in Notts., Norfolk, Suffolk and Somerset in 1927. Special investigations on this disease have been in progress at the Research Station, Long Ashton, Bristol. **Scab** (*Fusicladium saliciperdum* (Allesch. & Tub.) Lind.) was noted in Somerset in 1927 whilst *Marssonina salicicola* Bres. was reported causing **Anthracnose** there in that year.

Rhytisma symmetricum (Tul.) Müll., noted on Willow in Norfolk in 1926, appears to be a fungus new to Britain. **Rust** (*Melampsora* spp.) occurred each year in Somerset both on the leaves and also in canker form. It was also reported once from Lincs. *Armillaria mellea* (Vahl) Fr. was reported killing young trees in Somerset in 1927, whilst the fructifications of the **Silver Leaf** fungus were noted on willows in Hereford in the same year.

DISEASES OF BULBS, CORMS, ETC.

During the three years under review there have been numerous complaints and inquiries concerning the various diseases of the commoner bulb- and corm-forming flowering plants, and special attention has been devoted to them. The following briefly summarizes the position up to the end of 1927 :—

HYACINTH.—Yellow Disease (*Bacterium Hyacinthi* Wakk.) was very prevalent during 1926 and 1927 in imported bulbs, in some cases up to 40 per cent. of the consignment being affected. It was also reported in 1927 at a nursery in Nottingham. **Soft Rot** (*Bacillus carotovorus* L. R. Jones) was reported from Herts in 1926 (*12th Ann. Rept. Exp. Res. Sta. Cheshunt, Herts.* 1927, p. 32). No cases of **Black Slime** (*Sclerotinia bulborum* (Wakk.) Rehm) have been seen, but plants were received, on a number of occasions, exhibiting the non-parasitic **Stalk Break,** in which the stalk of the inflorescence, before it has fully elongated, becomes quite detached at its base from the axis of the bulb.

TULIP.—Fire (*Botrytis Tulipae* (Lib.) Lind) was common in some districts each year, severe cases occurring in Berks, Devon and Cornwall. It was very prevalent in Lincs in 1925 and 1927, but only slight in the intervening year. Cases were reported also from Hants, Oxfordshire, Lancs and Cheshire.

The first authentic case of **Grey Bulb Rot** (*Sclerotium Tuliparum* Kleb.) in this country appears to have been one observed in 1922 by Miss Wakefield at the Royal Botanic Gardens, Kew, but no record of it was published at the time. The first definitely recorded case appears to be that described by Brooks in Cambs. in 1926 (*Gard. Chron.* 79, 1926, pp. 271–2). Later in the same year the disease was found in Berks and Oxfordshire, while in 1927 it occurred again in the latter county and also in Bucks. Whetzel and Arthur have recently described the disease, as it occurs in the U.S.A., rather fully (*Cornell Univ. Agr. Exp. Sta. Mem.* 89, 1925, 18 pp.).

The non-parasitic trouble in forced tulips known as **Topple** and sometimes called Wet Stem by growers, was reported for the first time in 1927, in the varieties Boule de Neige and Aplatie. Watery, translucent regions appear on the flower stalks just above the nodes. Drops of sweet liquid exude at these places, and this is followed by a shrinkage, furrowing and withering of the affected tissues. Ultimately the stem topples over at this point and may break off. The trouble is believed to be due to vigorous root action continuing after a rather rapid fall of temperature in the air of the forcing house.

NARCISSUS.—White Mould (*Ramularia Vallisumbrosae* Cav.) was prevalent each year in Devon and Cornwall, but in the first

two years it caused no appreciable damage. It was also noted in Warwickshire in 1926. In most of the material examined black bodies, probably functioning as sclerotia, were present, which do not appear to have been described in the scanty literature on this disease. Pure culture work at the Pathological Laboratory has shown that these bodies really belong to this Ramularia and not to any secondary fungus accompanying it. Similar structures are found, apparently, in other species of the genus (*cf.* C. Killian in *Ann. des Epiphyties.* 12, 1926, p. 147).

Stagonospora Curtisii (Berk.) Sacc., was observed on dead or dying leaf tips in the Isles of Scilly in 1926, and in Cornwall, Bucks, and Herts in the following year. It was also found in Flints in June, 1927, in the form of elongated spots scattered over the leaves. *S. Narcissi* Hollós, reported as new to this country by Ramsbottom in 1918 (*Jour. Roy. Hortic. Soc.* 43, 1918, p. 57), is almost certainly only another name for this fungus. The name **Leaf Scorch** is suggested for the disease, which has as yet by no means been investigated thoroughly.

A species of *Rosellinia*, probably *R. necatrix* (Hart.) Berl., was observed to be serious over small areas in the Isles of Scilly in 1926. The underground parts of the varieties Soleil d'Or, *Narcissus poeticus* and Princeps, in particular, were badly attacked. The same disease was also found affecting Scilly White on the mainland in Cornwall. **Smoulder** (*Botrytis narcissicola* Kleb.) occurred a few times, and a new disease, **Fire,** caused by *Botrytis polyblastis* Dowson (*Gard. Chron.* 80, 1926, pp. 68–69) was found in S.W. England and in Northern Ireland in 1926. *Botrytis cinerea* Pers. occasioned much damage to the leaves and flower buds in the Tamar Valley in 1926, and a presumed virus disease, apparently identical with the so-called **Grey Disease** of the Netherlands, was prevalent among several varieties in Cheshire in 1927. Each year a trouble of uncertain origin, usually referred to as **Basal Rot,** was extremely prevalent in consignments of imported Narcissus bulbs, and in 1926 a somewhat similar but probably not identical disease was reported as locally serious in the Isles of Scilly and in Cornwall. A species of *Fusarium* is almost invariably associated with the rot, which appears to begin at the basal plate and to work upwards. This disease, however, requires much more precise definition and thorough investigation ; up to the present the name has been used somewhat loosely, and may very likely cover more than one specific disease.

LILY.—The **Lily Disease,** now usually referred to *Botrytis elliptica* (Berk.) Cooke, was noted in Berks in 1926 and in Yorks in 1927.

GLADIOLUS.—**Leaf Spot** (*Septoria Gladioli* Pass.) was reported in 1925, apparently for the first time in this country, from Devon and Cornwall. It was observed in Cornwall again in 1926, and

in that and the following year it also appeared in the Isles of Scilly. The **Hard Rot** stage on the corms was detected in 1926 in imported consignments of corms. A full account of this disease is given by L. M. Massey in *Cornell Univ. Agr. Exp. Sta. Bull.* 380, 1916, pp. 149–181.

Dry Rot (*Sclerotium Gladioli* Massey) was recognized in this country for the first time in May, 1926, when specimens showing the disease were received from the Isles of Scilly. It has also been observed more recently in Middlesex, Herts and Cambs., and the fungus has been isolated from imported corms on several occasions. The disease is dealt with in *Phytopathology* 18, 1928, p. 519.

A **Storage Rot,** due to *Penicillium Gladioli* McCull. & Thom (*Jour. Agric. Res.* 36, 1928, pp. 217–224), has been found causing appreciable losses in imported corms on a number of occasions during the three years; but **Smut** (*Urocystis Gladioli* (Requien) W. G. Sm.) has not been seen since 1923, and no undoubted cases of **Scab** (*Bacterium marginatum* McCull.) were observed.

CROCUS.—Copper Web, due to *Helicobasidium purpureum* (Tul.) Pat. (*Rhizoctonia Crocorum* (Pers.) DC.), was found on a few corms obtained from Hereford in 1926. This fungus has apparently not been observed on Crocus in England since 1860, when it was recorded by Berkeley (*Outlines of British Fungology*, p. 410) as occurring on roots of Saffron and other plants.

IRIS.—Severe cases of **Leaf Spot** (*Heterosporium gracile* Sacc.) were noted in Hants in 1926, and in Devon and Kent in 1927. The disease was also observed in Kent, Northumberland and Cumberland in 1925, and in Herts in 1926. Two species of *Didymellina* have been said to be the perfect stage of this fungus, namely *D. Iridis* (Desm.) v. Höhnel (W. B. Tisdale—*Phytopath.* 10, 1920, pp. 148–163) and *D. macrospora* Kleb. (H. Klebahn—*Ber. d. deutsch. bot. Gesell.* 42, 1924, pp. 60–71). The latter is probably the correct name.

Rust (*Puccinia Iridis* (DC.) Wallr.) was common around Cardiff and in Somerset in 1925, was observed in Somerset and Berks in 1926, and at two centres in Yorks in 1927. A species of *Botrytis*, shown by inoculation experiments to be the cause of a hitherto undescribed rot of the rhizomes of *Iris susiana*, was observed in Kent in 1926. The **Ink Disease** (*Mystrosporium adustum* Mass.) which has apparently not been recorded in England since 1899, when Massee first described it (*Gard. Chron.* 25, 1899, p. 412), was found causing serious damage to the bulbs of *Iris reticulata* at Copplestone in Devon in 1927, and was noted on decaying leaves of Dutch Iris in Flintshire the same year. It is probable

that this disease is more common than the records would suggest. **Grey Bulb Rot** (*Sclerotium Tuliparum* Kleb.) was recorded on bulbs of *Iris reticulata* for the first time in this country in Cambs. in 1926.

ARUM (RICHARDIA).—Leaf Spot (*Phyllosticta Richardiae* Hals.) was common in the Isles of Scilly in 1925 and 1926, and was reported from Herts in the latter year and from Northumberland and Cumberland in 1927. In 1925 **Corm Rot** (*Bacillus Aroideae* Towns.) was severe in a consignment of corms imported from the Channel Isles, and caused heavy losses in Kent. It was reported as prevalent in Sussex in the same year, and was noted in Somerset in 1926. A species of *Rosellinia* (probably *R. necatrix* (Hart.) Berl.) was responsible for the death of local patches of Arums in the Isles of Scilly in 1926. *Sclerotium Rolfsii* Sacc. was isolated from imported diseased corms in the same year, but it has not yet been reported as doing damage to plants grown in this country. K. Nakata (*Bull. Sc. Fak. Terk. Kjusu Imp. Univ.* 2, 1926, p. 7) has described *Hypochnus centrifugus* (Lév.) Tul. as the perfect stage of this fungus. Possibly *Corticium centrifugum* (Lév.) Bres. would be a more suitable binomial. E. S. Salmon and W. M. Ware (*Gard. Chron.* 81, 1927, p. 234) reported a case of **Root Rot,** due to *Phytophthora Richardiae* Buism. (*Tijdschr. o. Plantenziekten* 33, 1927, p. 17), from Berkshire and from Kent, in the spring of 1927.

INDEX TO PARASITES.

(NOTE.—In order to save space and avoid repetition in the text the names of parasites that attack more than one host are frequently given for the principal host only.)

PAGE

Actinomyces scabies (Thaxt.) Güssow 18, 26
„ *tumuli* Millard & Beeley 26
Alternaria Brassicae (Berk.) Bolle 25, 53
„ *Dianthi* Stev. & Hall 61
Aphanomyces euteiches Drechsl. 29
Armillaria mellea (Vahl) Fr. 44, 45, 48, 51, 52, 63, 65
Ascochyta sp. 58
„ *Brassicae* Thüm. 33
„ *Dianthi* Lib. 61
„ *Fabae* Speg. 28
„ *Orobi* Sacc. 30
„ *Pisi* Lib. 29
Bacillus Aroideae Towns. 69
„ *carotovorus* L. R. Jones 25, 34, 35, 39, 66
„ *Lathyri* Manns & Taubenh. 28, 37, 62
„ *phytophthorus* Appel 20
Bacterium coronafaciens Ch. Elliott 13
„ *Delphinii* Bryan 60
„ *Hyacinthi* Wakk. 66
„ *marginatum* McCull. 68
„ *pyocyaneum* (Gessard) Lehm. & Neum. 36
„ *Rhaponticum* Millard 40
„ *tumefaciens* E. F. Sm. & Towns. .. 26, 45, 48, 54, 62, 63
Botrytis spp. 30, 40, 54, 55, 56, 60, 61, 68
„ *Allii* Munn 38
„ *byssoidea* Walker 38
„ *cinerea* Pers. 20, 28, 34, 36, 37, 49, 51, 58, 60, 61, 63, 64, 67
„ *elliptica* (Berk.) Cooke 67
„ *narcissicola* Kleb. 67
„ *Paeoniae* Oud. 60
„ *polyblastis* Dowson 67
„ *squamosa* Walker 38
„ *Tulipae* (Lib.) Lind 66
Bremia Lactucae Regel 36
Cephalosporium Asteris Dowson 63
Cercospora beticola Sacc. 27
„ *Bloxami* Berk. & Br. 25, 27
„ *cantuariensis* Salm. & Worm. 58
„ *Fabae* Fautr. 28
„ *Melonis* Cooke 34
„ *Rubi* Thüm. 54
Cladosporium album Dowson 62
„ *carpophilum* Thüm. 48, 50
„ *cucumerinum* Ell. & Arth. 33
„ *fulvum* Cooke 37
„ *herbarum* (Link) Fr. 29
„ *Pisi* Cug. & Mac. 29
Clasterosporium carpophilum (Lév.) Aderh. 47, 49, 50
Claviceps purpurea (Fr.) Tul. 12

PAGE

Coleosporium Campanulae (Pers.) Lév. 63
„ *Senecionis* Fr. 63
Colletotrichum atramentarium (Berk. & Br.) Taubenh. 20, 37
„ *Lindemuthianum* (Sacc. & Magn.) Bri. & Cav. 28
„ *oligochaetum* Cav. 33
„ *tabificum* Pethybr. 37
Coniothecium chomatosporum Corda 42
Coniothyrium Fuckelii Sacc. 62
„ *Rosarum* Cooke & Harkn. 62
Contarinia nasturtii Kieff. 25
Corticium centrifugum (Lév.) Bres. 69
„ (*Rhizoctonia*) *Solani* Bourd. & Galz. .. 19, 33, 36, 39, 63, 64
Cronartium ribicola Dietr. 52
Cryptosporium minimum Laub. 62
Cuscuta Gronovii Willd. 23
„ *suaveolens* Ser. 23
„ *tinei* Insenga 23
Cystopus candidus (Pers.) de Bary 24, 33, 60
Cytospora spp. 44, 48
„ *leucostoma* Sacc. 49
Cytosporella fructorum March. 42
Cytosporina sp. 49
„ *ramealis* (Desm. & Rob.) Petrak 54
Diaporthe perniciosa March. 44, 48, 49, 54
Didymascella sp. 65
Didymella applanata (Niessl) Sacc. 53
„ *Lycopersici* Kleb. 36, 55
Didymellina Iridis (Desm.) v. Höhnel 68
„ *macrospora* Kleb. 68
Dilophospora Alopecuri (Fr.) Fr. 12
Diplocarpon Earliana (Ell. & Everh.) Wolf 55
„ *Rosae* Wolf 62
Diplodina Passerinii Allesch. 64
Dothidella Trifolii (Pers.) Bay.-Elliott & Stans. 30
Epichloe typhina (Fr.) Tul. 31
Erostrotheca multiformis Martin & Charles 62
Erysiphe Cichoracearum DC. 34, 63
„ *graminis* DC. 12
„ *Polygoni* DC. 24, 28, 30, 32, 59, 60
Exobasidium Vaccinii (Fuck.) Woron. 64
Fabraea maculata Atk. 45, 50
Fomes igniarius (Linn.) Fr. 48
„ *pomaceus* (Pers.) Lloyd 43, 48
Fuckelia conspicua Marchal 42
Fusarium spp. 12, 13, 40, 58, 60, 64, 67
„ *caeruleum* (Lib.) Sacc. 20
„ *fructigenum* Fr. 42
„ *lateritium* Nees 56
Fusicladium carpophilum (Thüm.) Oud. 48
„ *saliciperdum* (Allesch. & Tub.) Lind. 65
Gibberella sp. 58
„ *moricola* (de Not.) Sacc. 56
Gloeodes pomigena (Schw.) Colby 44
Gloeosporium sp. 56
„ *album* Osterwald. 43, 45
„ *concentricum* (Grev.) Berk. & Br. 27, 33
„ *venetum* Speg. 53
Glomerella cingulata (Stonem.) Spauld. & v. Schrenk 43, 45

PAGE

Gnomonia erythrostoma (Pers.) Auersw. 49
„ *leptostyla* (Fr.) Ces. & de Not. 56
Helicobasidium purpureum (Tul.) Pat. 20, 26, 30, 34, 40, 68
Helminthosporium Avenae (Bri. & Cav.) Eid. 13
„ *gramineum* Rabenh. 13
„ *sativum* Pamm. King & Bak. 13
Hendersonia Rubi Sacc. 54
Heteropatella Antirrhini Budd. & Wakef. 64
Heterosporium echinulatum (Berk.) Cooke 61
„ *gracile* Sacc. 68
Hypochnus centrifugus (Lév.) Tul. 69
Kabatiella caulivora (Kirchn.) Karak. 30
Keithia thujina Durand 64
Leptosphaeria Coniothyrium Sacc. 54
Macrosporium parasiticum Thüm. 39
Marssonina Fragariae (Sacc.) Kleb. 55
„ *Juglandis* (Lib.) Magn. 56
„ *panattoniana* Berl. 36
„ *salicicola* Bres. 65
Mastigosporium album Reiss var. *muticum* 31
Melampsora sp. 65
Microsphaera Grossulariae (Wallr.) Lév. 51
Mycosphaerella brassicicola (Fr.) Lindau 27, 33
„ *Fragariae* (Tul.) Lindau 55
Mystrosporium adustum Mass. 68
Myxosporium corticolum Edgert. 42
Nectria cinnabarina (Tode) Fr. 51
„ *galligena* Bres. 42
„ *Rubi* Osterw. 54
Oidium sp. 60
„ *Chrysanthemi* Rabenh. 63
Oospora pustulans Owen & Wakef. 19
Ophiobolus graminis Sacc. 12
Orobanche minor Sm. 30
Penicillium expansum Thom 43
„ *Gladioli* McCull. & Thom 68
Peronospora parasitica (Pers.) Tul. 24, 32, 60
„ *Schachtii* Fuck. 26
„ *Schleideni* Unger 38
„ *Trifoliorum* de Bary 30
„ *Viciae* (Berk.) de Bary 29, 31, 62
Pestalozzia Hartigii Tüb. 64
Phacidiella discolor (Mout. & Sacc.) Poteb. 42, 45
Phoma spp. 20, 58
„ *apiicola* Kleb. 35
„ *Betae* (Oud.) Frank 25, 26
„ *Lavandulae* Gab. 65
„ *Lingam* (Tode) Desm. 24, 32
„ *oleracea* Sacc. 24
Phomopsis cinerascens (Sacc.) Trav. 56
„ *incarcerata* v. Höhn. 62
Phragmidium mucronatum (Pers.) Schlecht. 62
„ *Rubi-Idaei* (Pers.) Karst. 54
Phyllachora graminis Fuck. 31
Phyllosticta Antirrhini Syd. 64
„ *cucurbitacearum* Sacc. 34
„ *Richardiae* Hals. 69
„ *Violae* Desm. 60

PAGE

Physalospora Miyabeana Fukushi 65
Phytophthora spp. 34, 35, 61, 64
„ *Cactorum* (Leb. & Cohn) Schroet. 43
„ *cryptogea* Pethybr. & Laff. 36, 60, 62, 63
„ *erythroseptica* Pethybr. 20
„ *infestans* (Mont.) de Bary 14, 37
„ *parasitica* Dast. 36, 37
„ *Richardiae* Buism. 69
Plasmodiophora Brassicae Woron. 24, 32
Plasmopara nivea Schroet. 34
„ *viticola* (Berk. & Curt.) Berl. & de Toni 55
Plectodiscella veneta Burkh. 53
Plowrightia ribesia (Pers.) Sacc. 52
Podosphaera leucotricha (Ell. & Everh.) Salm. 41, 50
Polyporus adustus (Willd.) Fr. 43
Polystictus versicolor Fr. 48
Pseudodiscosia Dianthi Hösterm. & Laub. 61
Pseudomonas campestris (Pamm.) E. F. Sm. 25, 32, 33
„ *destructans* Potter 25
Pseudoperonospora Humuli (Miy. & Tak.) Wilson 57
Pseudopeziza Medicaginis (Lib.) Sacc. 30
„ *Ribis* Kleb. 51, 52
„ *Trifolii* (Biv.-Bern.) Fuck. 30
Puccinia aegra Grove 60
„ *anomala* Rostr. 13
„ *Arrhenatheri* Erikss. 31
„ *Asparagi* DC. 40
„ *Chrysanthemi* Roze 63
„ *glumarum* (Schm.) Erikss. & Henn. 11
„ *graminis* Pers. 11
„ *Iridis* (DC.) Wallr. 68
„ *Lolii* Niels. 12, 31
„ *Lychnidearum* Link f. *Dianthi* Grove 61
„ *Malvacearum* Mont. 61
„ *Menthae* Pers. 40
„ *Phlei-pratensis* Erikss. & Henn. 31
„ *Phragmitis* (Schum.) Körn. 40
„ *Porri* (Sow.) Wint. 39
„ *Pringsheimiana* Kleb. 51
„ *Pruni-spinosae* Pers. 47, 60
„ *secalina* Grove 14
„ *triticina* Erikss. 11
Pyrenophora teres (Died.) Drechsl. 13
Pythium spp. 25, 28, 35, 60, 61, 62, 64
„ *de Baryanum* Hesse 33, 34
Ramularia Armoraciae Fuck. 33
„ *beticola* Fautr. & Lamb. 27
„ *lactea* (Desm.) Sacc. 60
„ *pastinacae* Bub. 34
„ *Rhei* Allesch. 40
„ *Vallisumbrosae* Cav. 66
Rhizoctonia Crocorum (Pers.) DC. 20, 26, 68
Rhynchosporium Secalis (Oud.) Davis 13
Rhytisma symmetricum (Tul.) Müll. 65
Roesleria hypogaea Thüm. & Pass. 45, 48
Rosellinia necatrix (Hart.) Berl. 21, 44, 51, 67, 69
Sclerotinia americana Nort. & Ezek. 50
„ *bulborum* (Wakk.) Rehm 66

PAGE

Sclerotinia cinerea Schroet. 43, 45, 47, 48
„ *Crataegi* Magn. 47
„ *Cydoniae* Schell. 50
„ *fructigena* Schroet. 43, 45, 47, 49
„ *Sclerotiorum* (Lib.) de Bary 20, 25, 34, 60, 63, 64
„ *Trifoliorum* Erikss. 30
Sclerotium cepivorum Berk. 39
„ *Gladioli* Massey 68
„ *Rolfsii* Sacc. 69
„ *Tuliparum* Kleb. 66, 69
Septogloeum sp. 61
Septoria sp. 63
„ *Apii* Chester 34
„ *culmifida* Korst. 31
„ *Dianthi* Desm. 61
„ *Drummondii* Ell. & Everh. 64
„ *Gladioli* Pass. 67
„ *Lavandulae* Desm. 65
„ *Leucanthemi* Sacc. & Speg. 63
„ *Lycopersici* Speg. 37
„ *nodorum* Berk. 12
„ *Petroselini* Desm. 35
„ *Rosarum* West. 62
„ *Rubi* West. 54
„ *Tritici* Desm. 12
Sphaeronema spp. 48
Sphaerotheca Humuli (DC.) Burr. 54, 57
„ *mors-uvae* (Schw.) Berk. 50
„ *pannosa* (Wallr.) Lév. var. *persicae* Woron. 49
„ *pannosa* (Wallr.) Lév. 62
Spondylocladium atrovirens Harz 19
Spongospora subterranea (Wallr.) Lagerh. 19
Sporidesmium putrefaciens Fuck. 27
Stagonospora Curtisii (Berk.) Sacc. 67
„ *Narcissi* Hollós 67
Stereum hirsutum (Willd.) Fr. 46
„ *purpureum* Pers. 42, 45, 46
„ *sanguinolentum* (A. & S.) Fr. 46
Synchytrium endobioticum (Schilb.) Perc. 16, 18
Taphrina bullata (Berk.) Tul. 45
„ *Cerasi* (Fuck.) Sadeb. 49
„ *deformans* (Berk.) Tul. 49
„ *insititiae* (Sadeb.) Johans. 48
„ *minor* Sadeb. 49
„ *Pruni* (Fuck.) Tul. 48
Thielavia basicola Zopf 28, 30, 37, 60, 63, 64
Tilletia Caries (DC.) Tul. 11
„ *foetens* (Berk. & Curt.) Trel. 11
Trichothecium roseum Link 43
Tympanis conspersa Fr. 44
Uncinula necator (Schw.) Burr. 55
Urocystis Cepulae Frost 39
„ *Gladioli* (Requien) W. G. Sm. 68
„ *occulta* (Wallr.) Rabenh. 14
„ *Violae* (Sow.) Fisch. v. Waldh. 60
Uromyces ambiguus Lév. 39
„ *Betae* (Pers.) Tul. 26
„ *Dactylidis* Otth 31

	Page
Uromyces Dianthi (Pers.) Niessl	61
,, *Fabae* (Pers.) de Bary	28
,, *flectens* Lagerh.	30
,, *Onobrychidis* (Desm.) Lév.	31
,, *Trifolii* (Hedw. f.) Lév.	30
Urophlyctis Alfalfae (Lagerh.) Magn.	30
Ustilago Avenae (Pers.) Jens.	12
,, *Hordei* (Pers.) Kellerm. & Swing.	13
,, *Kolleri* Wille	12
,, *nuda* (Jens.) Rostr.	13
,, *perennans* Rostr.	31
,, *Tragopogonis pratensis* (Pers.) Rouss.	40
,, *Tritici* (Pers.) Jens.	12
Venturia inaequalis Aderh.	41
,, *pirina* Aderh.	44
Verticillium sp.	58
,, *albo-atrum* Reinke & Berth.	20, 34, 37, 56
,, *Dahliae* Kleb.	36, 37, 40, 53, 64
,, *Vilmorinii* Westerd. & V. Luijk	63
Zopfia rhizophila Rabenh.	40

INDEX TO NON-PARASITIC DISEASES.

	Page
Bitter Pit (Apple)	44
Blossom End Rot (Tomato)	37
Blotchy ripening (Tomato)	37
Brown Neck (Wheat)	12
Canker (Parsnip)	34
Cauliflower (Strawberry)	55
Curly Dwarf (Potato)	22
Dry Rot (Mangold, Beet)	26
Glassiness (Apple)	44
Green Back (Tomato)	37
Grey Disease (Narcissus)	67
Heart Rot (Mangold, Beet)	26
Leaf Roll (Potato)	21
Leaf Scorch (Mangold, Apple, etc.)	27, 44
Lithiasis (Pear)	46
Mosaic (Potato, Hop, Tomato, etc.)	21, 27, 28, 34, 38, 52, 53, 59
Nettlehead (Hop)	59
Patch (Strawberry)	55
Phyllonecrosis (Sugar Beet)	26
Red Plant (Strawberry)	55
Reversion (Currant)	51, 53
Spraing (Potato)	20
Stalk Break (Hyacinth)	66
Streak (Potato)	22
Topple (Tulip)	66

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